MASTER PLAN UPDATE
FOR THE CITY OF
EL CENTRO, CALIFORNIA
SEWER SYSTEM AND
TREATMENT PLANT

PREPARED FOR
THE CITY OF EL CENTRO

PREPARED BY
ES ENVIRONMENTAL SERVICES
BERKELEY, CALIFORNIA

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To Council 11-18-87
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To Council & accepted
12-16-87
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INTRODUCTION

SECTION I
INTRODUCTION

In May of 1987, ES Environmental Services (ES2) received authorization by the City of El Centro to proceed with an upgrade of the Master Plan for the city sewer lines and wastewater treatment facilities. This report is an update of the Master Plan prepared by Design Sciences in 1977.

TOPICAL SUMMARY

This report's primary objective is to present the necessary data for present and future improvements to the sewer and wastewater facilities. The major items of consideration are:

1. The present flows to the wastewater plant are still within the design capacity. However, some process units have reached capacity during the winter months and will soon require upgrading.
2. The improvements done to the sewer system as recommended by the Design Sciences report have enabled the present system to adequately handle wastewater flows up until the present time.
3. Projected flows in the year 2000 will be more than the present sewer system can carry and specific lines throughout the city are pointed out for upgrade.
4. The two main lift stations have been in operation for about 50 years. Both of these stations are in need of improvements and/or replacement to handle both existing and projected flows.
5. The expense for treatment and sewer facilities has increased over the last ten years. Consequently a revenue program must be implemented in order to pay for the added costs that the city will be incurring over the next 10 to 20 years.

The present wastewater flows are slightly higher than the earlier study predicted, as is the population. These higher flows and the condition of the treatment plant will require upgrades to the treatment system in the near future.

REFERENCE MATERIAL

The information necessary to produce this report has been collated from a variety of sources, including the wastewater treatment plant staff, the city planning department, and the city engineer. Comprehensive computer models were used on both the treatment system and the sewer system in order to determine their capacities.

SECTION II

POPULATION PROJECTIONS

SECTION II
POPULATION PROJECTIONS FOR EL CENTRO

POPULATION PROJECTION

El Centro has experienced a fairly steady growth rate of 2.256 percent over the last ten years as opposed to the projected figure of 2.2 percent presented in the 1977 study. Table 1 indicates the projected population over the next twenty years at both the 2.2% and the 2.25% growth rate. The table also includes projected wastewater flows over the same period corresponding to the figure of 151 gallons per capita per day used in the 1977 report.

TABLE 1
CITY OF EL CENTRO MASTER SEWER PLAN POPULATION TRENDS

YEAR	POPULATION RECORDED @ 2.2%	POPULATION RECORDED @ 2.256%	WASTEWATER FLOWS @ 151 GAL/CAPITA
1977	22600	22600	3412600
78	23106	23179	3489042
79	23624	23772	3567197
80	24153	24380	3647102
81	24694	25005	3728797
82	25247	25645	3812322
83	25813	26301	3897718
84	26391	26975	3985027
85	26982	27665	4074292
86	27586	>>28373<<CORRECT	>>4165556<<
87	28204	29100	4258864
88	28836	29845	4354263
89	29482	30609	4451798
90	30143	31392	4551519
2000	37617	40420	5680167
2006	43185	47039	6520935
2020	58565	66465	10000000

According to current census extrapolations, the above figures for El Centro current population are correct at about 28373 full time residents. Due to its proximity to the border and the prevailing agricultural nature of the area, El Centro experiences fluctuations in wastewater flows which currently average anywhere from 4.0 to 4.6 MGD.

2. PROJECTED WASTEWATER FLOWS

In determining the major tributary areas contributing to the wastewater plant, population figures for the various zoning areas in El Centro have been used to calculate the projected flows for each area. According to the city zoning regulations for the expected number of dwelling units per acre and capita per dwelling unit, and assuming

commercial areas are given a population density equal to the R1 areas, the maximum population designed for El Centro's present city limits is about 65,000. This figure will be reached in the year 2020 at the current growth rate.

PROJECTED EL CENTRO WASTEWATER FLOWS

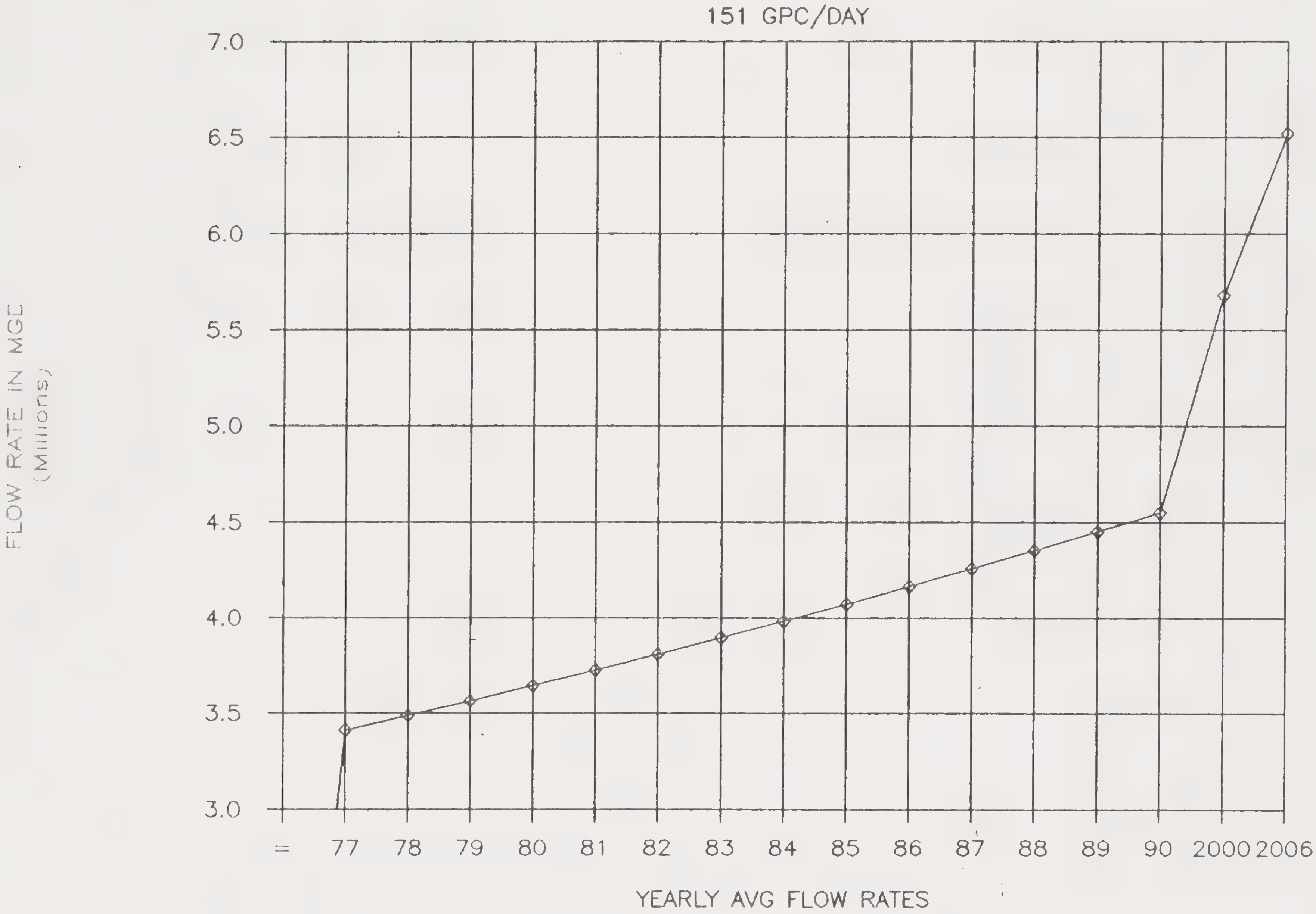
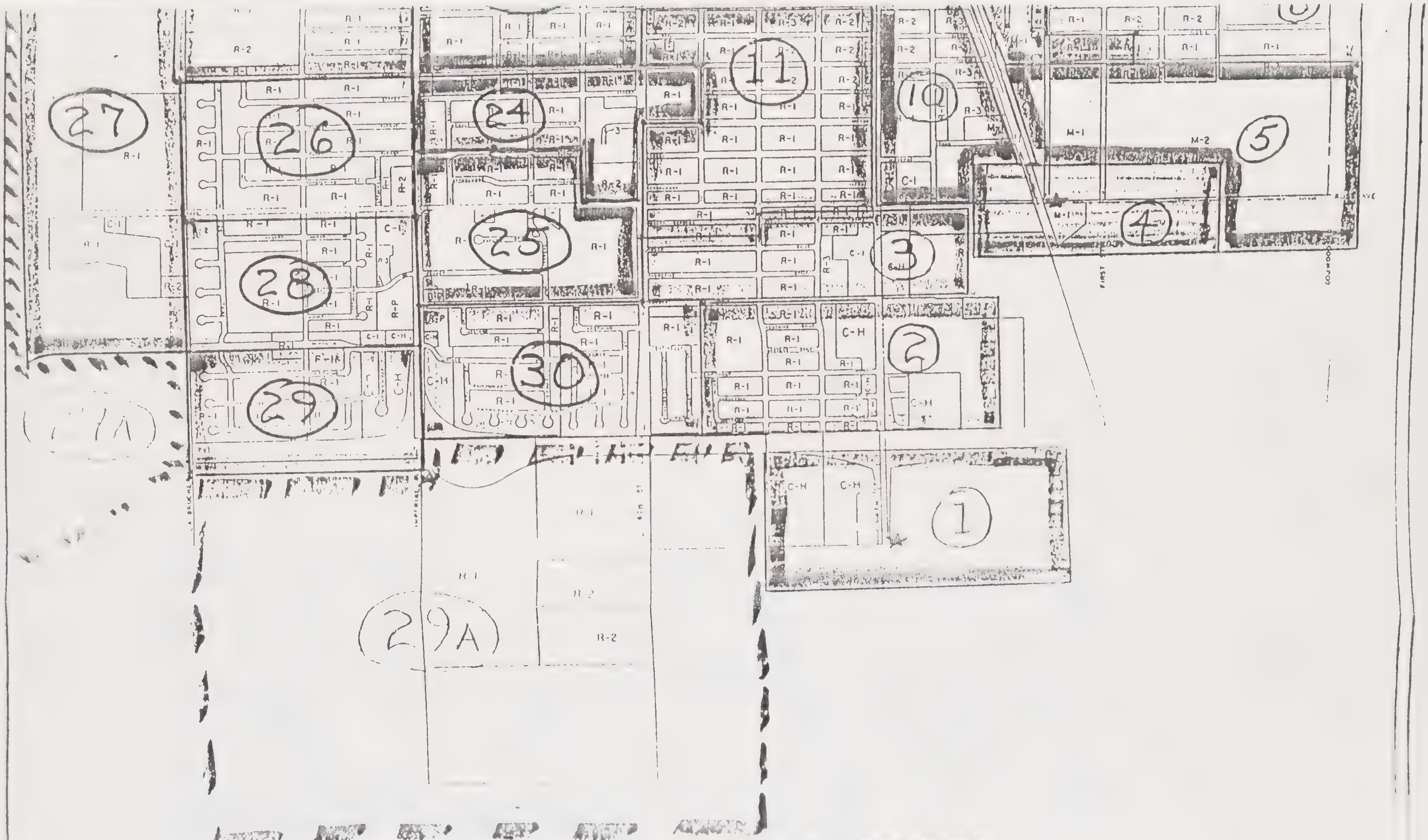


FIGURE 1

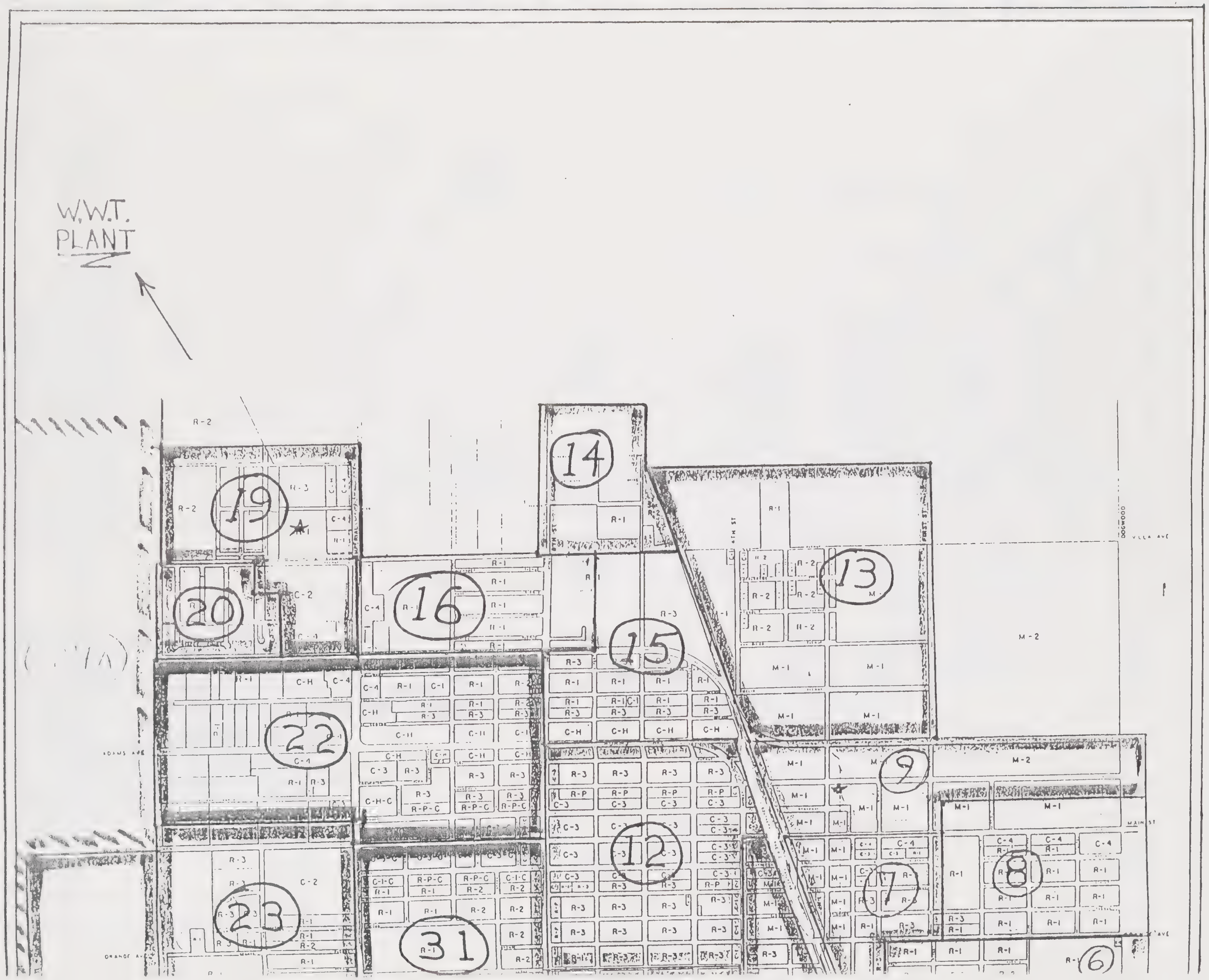
SECTION III

SEWER SYSTEM CAPACITY



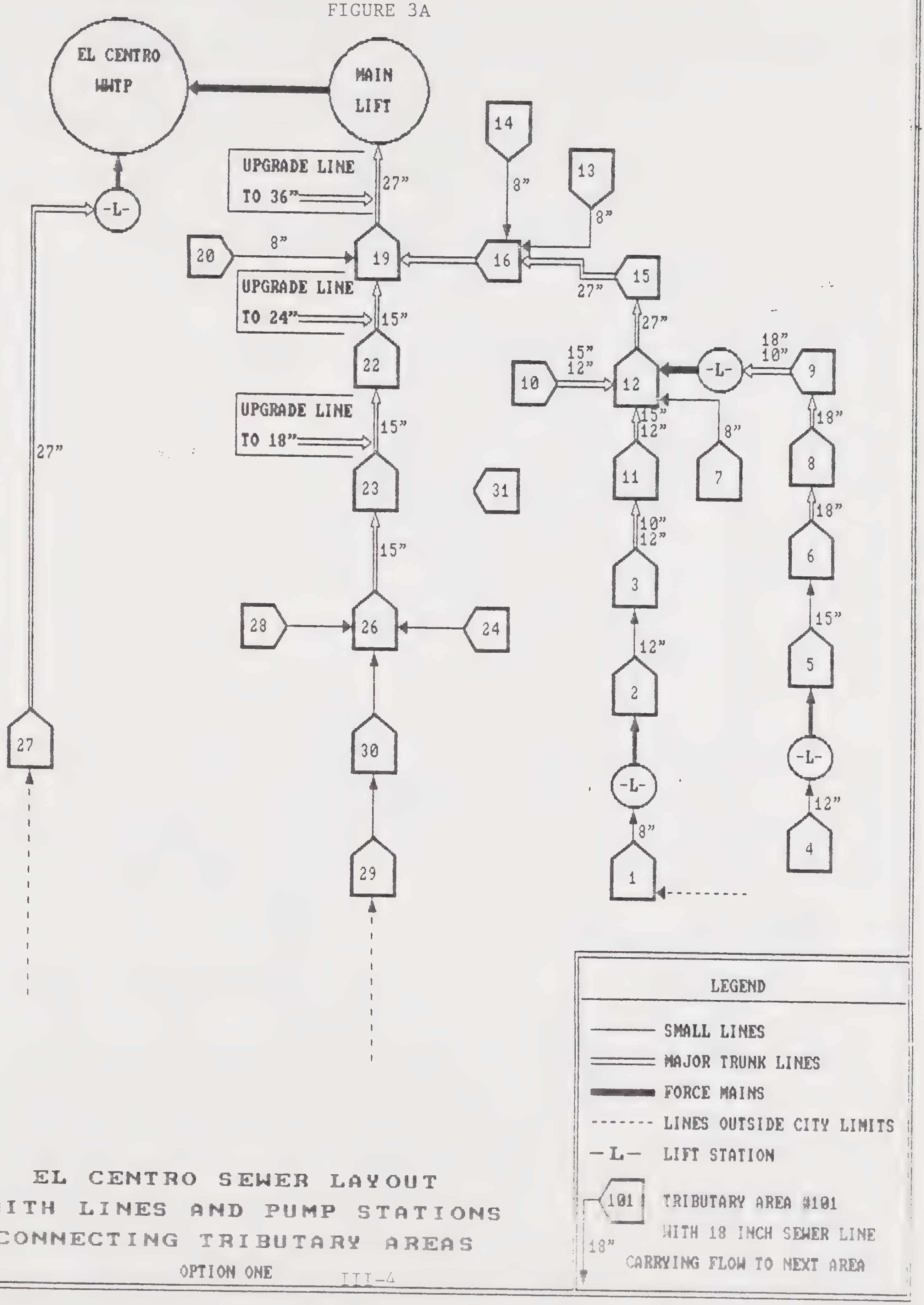
TRIBUTARY AREAS FOR EL CENTRO

PROJECTED WASTEWATER FLOW



W.W.T.
PLANT
14
19
20
16
15
13
22
9
12
7
8
23
31
6
R-1
R-2
R-3
R-P
R-P-C
C-1
C-2
C-3
C-4
C-H
C-H-C
C-1-C
M-1
M-2
6TH ST
4TH ST
FIRST ST
DOGWOOD
VILLA AVE
ADAMS AVE
MAIN ST
ORANGE AVE

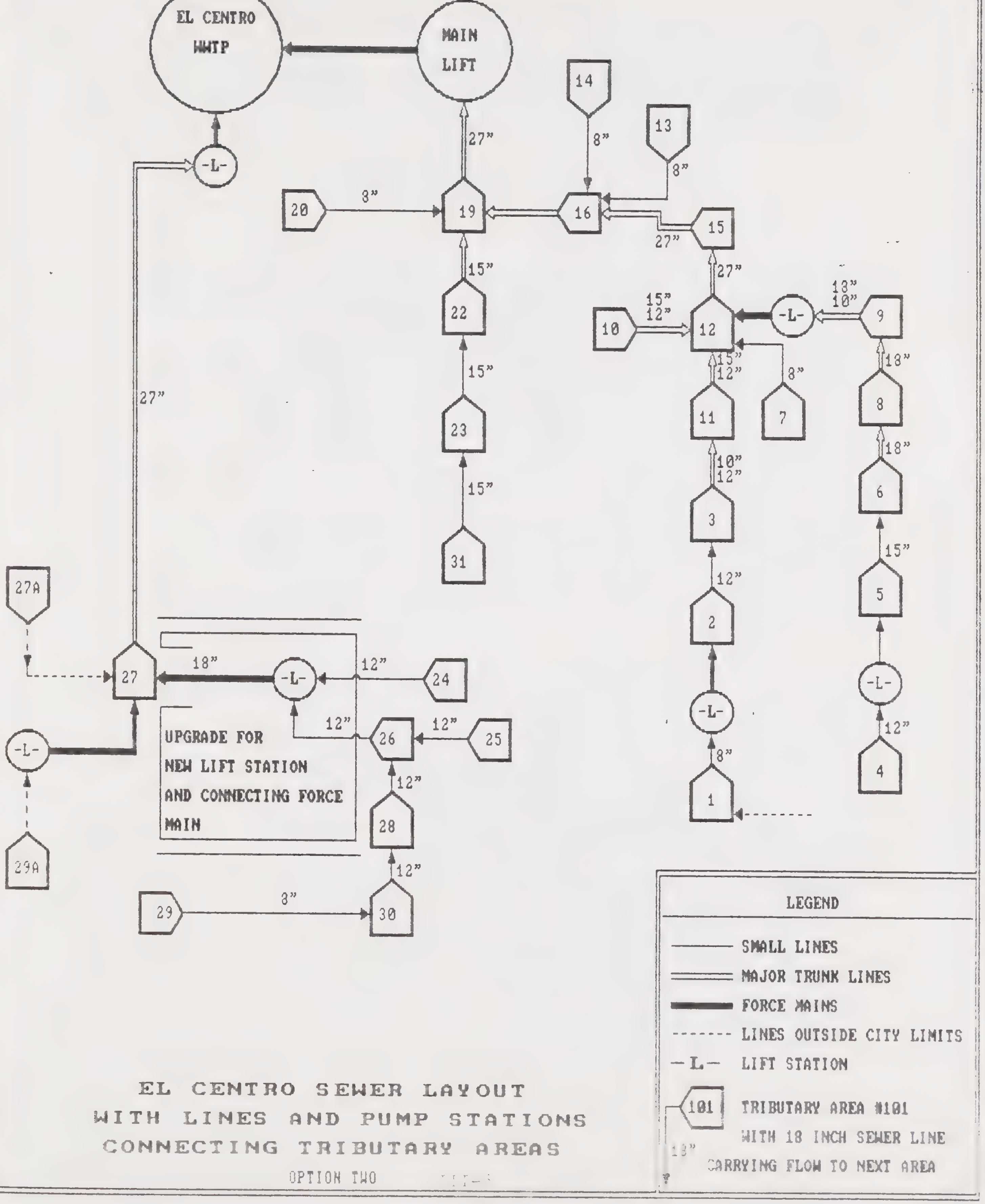
FIGURE 3A



EL CENTRO SEWER LAYOUT
WITH LINES AND PUMP STATIONS
CONNECTING TRIBUTARY AREAS

OPTION ONE

FIGURE 3B



EL CENTRO SEWER LAYOUT
WITH LINES AND PUMP STATIONS
CONNECTING TRIBUTARY AREAS

OPTION TWO

Two possible sewer upgrade options are indicated by figures 3.a and 3.b. Option one utilizes the present sewer system configuration and gravity flow with a new line along the entire length of Imperial Ave. The second option utilizes a new lift station at Imperial and Hamilton to direct wastewater flows to the new La Brucherie sewer line. Major trunk lines are specified as a result of flow volume and size of line rather than just size of line alone.

PROJECTED SEWER LINE IMPROVEMENT COSTS

WEST SIDE

As the City is aware, the Imperial line is too small for future flows. The recently constructed line along La Brucherie will be adequate for flows well into the 21st century. This could include diverted flows from the southern area of town along Imperial. This option will be referred to as option two hereafter. The cost for diverting the flows from Imperial to La Brucherie is estimated to be around $500,000 in 1986 dollars. This figure incorporates a new pump station and 2700 feet of force main. Alternately the City could upgrade the entire Imperial Ave. line from HWY 8 to the main lift station. This will be called option one. The cost for upgrading the Imperial line to handle flows into the 21st century is estimated to be around $1,000,000 in 1986 dollars. Neither of these figures include engineering, and both assume that extensive pumping due to ground water intrusion will not be necessary during construction. Pumping costs may well be extensive for the deeper line along Imperial depending on the time of year and weather conditions. ES2 recommends the diverted option or option two due to the much lower estimated cost.

As flows are routed to the new La Brucherie line additional considerations include the capacity of the existing lift station at the terminus of this line adjacent to the wastewater treatment plant. The actual capacity of the sewer line ranges from 5 MGD at the southernmost section and increases to almost 7 MGD near Villa Ave at the transition point from a 27 inch line to a 30 inch line. The final section of 30 inch line has a capacity of over 8 MGD. This line is capable of handling future expansions both South of I 8 and West along Austin Road as represented by areas 27A and 29A on Figure 2. The problem with this line is the existing lift station adjacent to the plant. The capacity of this station is presently 1.18 MGD for average flows and a maximum of about 1.6 MGD for peak flows. Option two would require an upgrade of this lift station by 1995 assuming no further expansion south of I 8. An upgrade of this lift station to handle flows until 2000 would require a simple speed change on the pumps from 1050 to either 1150 or 1250 depending on the required flow. Additional upgrades using the existing station would require either increased motor size and/or larger force mains. This upgrade will be considered further within the next section.

SOUTH SIDE

Major trunk lines in the southern section of town near HWY 8 are presently adequate with some room for expansion. This area is furthest from the plant and largely rural and suburban. The new lift stations at the intersections of Ross Street and the railroad tracks, at 4th Street and Wake Street, and by Imperial Avenue and the Highway are in good condition and have additional capacity for limited expansion. Area 29A on Figure 2 constitutes almost a thousand acres which will be considered for expansion south of I 8. For typical R1 zoning with about 15 people per acre (about 15,000 people) times 151 gallon per person per day, this area could conceivably generate over 2 MGD to the treatment plant. The existing capacity of the lift station by Imperial Ave and I 8 (I&I 8) which would handle most of any new flow is 200 gpm per pump or 288,000 gallons per day. This relates to about 2000 people total. Any growth past this figure would require upgrades not only to the existing lift station but also upgrades to the lift station for the La Brucherie line adjacent to the treatment plant. It is important to repeat that this evaluation assumes R1 zoning with about 15 people per acre. The City can adjust the actual expected flows based on El Centro's actual zoning needs and the resulting average flow per acre depending on the representative number of people per zone type.

Due to the type of construction of the new package type lift stations in El Centro, upgrades can be very simple and inexpensive depending on the degree of flow change. Items requiring change in order of preference are:

1. Impeller speed on the pump
2. Effluent force main diameter
3. Motor horsepower and motor control center
4. Entire lift station

As most of the lift stations in El Centro are at the low end of their respective pump curves, option one is possible for initial upgrades such as would be required for the Imperial Ave and I 8 lift station and the La Brucherie Lift Station (LBLS) adjacent to the plant. Due to the uncertain nature of projected expansion and where it will occur, costs will be listed as follows without inclusion in the overall funding structure. The City will then have the option of adding the required funding per these costs depending on which expansion option is considered.

1. Expansion into area 27A between La Brucherie and Austin Road. Cost indicates expected year of expansion in 1986 dollars.
    a. 1995 - upgrade LBLS to 2 MGD with impeller change cost - $5,000.
    b. 1995 - 2000 - increase the capacity of the LBLS to handle 4 MGD with a change in force main size cost - $40,000.
2. Expansion into area 29A to McCabe Road. Cost in 1986 dollars whenever expansion may occur.

a. Options one and two above of lift station upgrades, impeller speed change and effluent pipe size change, will not be as viable for the I&I 8 lift station due to its present configuration of motor, pump and force main line size. The Cost to increase pump speed to handle another 100,000 gpd would be similar to 1.a above, but the added capacity is not significant. Any significant change would require either a replacement of pump, motor and motor control center, and/or a change in effluent pipe size. The cost for the latter is approximately \$120,000 while the cost for the former is about \$50,000. Due to the high energy costs of pumping with high head pressures, the City should consider both upgrades concurrently. This would be cheaper in the long run as a small motor would then be required yet could allow the City to increase the lift station capacity as required by increasing the pump speed.

Conclusion

Expansion on the West Side of town to Austin Road will not require major upgrades of the existing LBLS. Cost will range from \$5,000 to \$40,000 depending on the extent of the expansion. Expansion south of I 8 however will require a major upgrade of the existing I&I 8 lift station of \$170,000. Additional upgrading of the LBLS may then be required for new motor and control center at \$40,000 if flows from south of I 8 exceed 1.0 MGD. These projected costs are difficult to place in both time and extent so they will not be included within the funding requirement section. However, the City must realize that these costs are real and if expansion in these areas occurs future funding requirements must be amended to reflect these added expenses.

EAST SIDE

The east side of town contains some of the oldest sections of the collection system. Recent renovations have provided relief to the worst sections of lines as recommended in the 1977 report by Design Sciences following video inspection. Two potential problem areas remain; the first is that the existing 8 inch line on Third Street going into the Commercial Ave Line is nearing capacity and should be enlarged before 1990.

The estimated cost of replacing this line with 15 inch vitrified clay line is \$82,000.

This line is not deep and groundwater pumping may not be a problem. The second area would be directly along Third Street on up to Olive Street by the year 1995 with an approximate cost of \$100,000 for a 12" VC line.

NORTH SIDE

The lines in this area are closest to the plant and therefore receive flows from throughout the city. Problems arising from maximum peak flows will result in surcharging in this area first. The only line showing serious problems by 1990 is the Imperial line from Hamilton Street to Villa Street, and specifically in area 22 on figure 2. With the diversion to La Brucherie, this area should present no serious problems.

The existing 8 inch line running between Villa And Eucalyptus from 4th across the railroad will require replacement by 1996. Unless installation of a 8-inch line is a lot cheaper, it seems the City would be happier with only one line to maintain. Installation of a 12-inch line would cost about $120,000. Otherwise, collection lines in this area have adequate capacity throughout the entire planning period. Due to the overall age of this section, maintenance will remain a high priority.

SECTION IV

LIFT STATIONS

SECTION IV
LIFT STATIONS

MAIN LIFT STATION

The main lift station has been in operation since 1935 and is in relatively good condition considering its age. Much of the equipment in the station is original. The pumping capacity has been increased over the years to keep up with the rising flows, and further increase will be required in the future. Refurbishment and replacement of some major components are recommended by ES2. These include:

1. Refurbishment of the building and the metal structures at the earliest possible date. The concrete and metal structures, such as handrails, pump bases, and piping supports are showing wear.

2. A preventive maintenance (pm) schedule should be set up for not only the main lift station, but for all of the city lift stations.

3. Replacement of the influent piping valves. These valves are outdated and incapable of being refurbished due to their age.

4. Replacement of the major control panel with modern instrumentation. The electrical components within the control panel are out of date and impossible to replace. Each minor breakdown becomes increasingly difficult to overcome as replacement parts and maintenance personnel familiar with such old equipment become harder to find.

5. Replacement of the existing stand-by generator with a new 200 kw diesel unit. The estimated cost of a new generator is about $40,000 installed. The present generator is still operable and could be used in some capacity within the city. However, the control panel, is out of date and virtually impossible to repair. The city would be better served with the purchase of a new stand-by generator that could be depended upon and either selling, scraping, or refurbishing the existing generator for alternate use in a less critical capacity.

6. Addition of a mechanically cleaned bar screen in the near future. The estimated cost is about $100,000. With increasing influent flows and larger influent lines, the likelihood of large articles entering the main lift station increases. The existing muffin monsters are a limiting factor with no dependable stand-by system should they go down and become clogged with incoming debris.

7. The underground comminution room has been the source of odor problems which should be alleviated. Generally the simplest solution is to increase vent air and direct the vent air from outside the lift station inward. If this proves insufficient a small scrubbing system should be installed just upstream of the effluent vent to abate the problem. Cost of about $20,000.

8. The addition of a prechlorination system to chlorinate the wastewater coming into the pumping station is suggested for the following reasons:

   a. Odor control. By the time some influent flows arrive at the lift station, a considerable amount of time may have elapsed. This results in an odorous septic condition that results in the production of H2S and methane. Small dosages of chlorine will alleviate this problem.
   b. Corrosion control. The production of H2S results in an acidic condition as sulfuric acid. The result is the attack of concrete and metal structures within the plant and sewer lines leading into and throughout the plant.
   c. Grease removal. Chlorination has been shown to be an effective agent in the control of grease coming into the plant.

   The cost for such a system would be in the neighborhood of $40,000.

9. Replacement of one of the two 30 HP pumps with another 60 HP pump to assure stand-by capacity for increasing influent flows. The estimated cost is $7,000.

EASTSIDE LIFT STATION

The expected flows for the eastside lift station will be over a million gallons a day by 1990. The present capacity of the station is about 1.7 MGD with one pump operating and about 3.0 MGD with both pumps running. This should be adequate throughout the planning period. However, the entire structure is in very poor condition. The influent bar screen is badly deteriorated, and the pumps are being operated with little or no screening of influent wastes. The probes that control upper and lower levels in the well are barely operable and virtually impossible to maintain due to deterioration of the wet well support structure. The electrical panel and controls within the building are outdated and should be replaced. No stand-by power is available.

This lift station should be replaced with a modern lift station with the same capacity as the present system. Due to the location and the expected flows, full time stand-by power generation should also be provided. An underground lift station similar to the new skid mounted Gorman Rupp lift stations could be installed for about $125,000. This would include new wet well, pumps and controls, and stand-by power.

The existing pumps could then either be sold, scrapped, or used as stand-by units for the main lift station.

LIFT STATIONS No.1, No.2, & No.3.

No.1 at Ross and the Railroad.

Maximum flows expected in year 2000 = 142,000 GPD.
Capacity of station @ 200 GPM per pump = 288,000 GPD.

This station is adequate and will remain so throughout the planning period with proper operation and maintenance to preserve the stations-integrity and dependability.

No.2 at 4th Street and Wake Street.

Maximum flows expected in year 2000 = 265,000 GPD
Capacity of station is equal to No.1 above at 288,000 GPD.

This station should also be adequate throughout the planning period. However, due to the expected peaks for this area, and the flows which may originate from new population growth, flow data should be updated every five years to assure the station remains adequate.

No.3 by Imperial Highway 8.

As with stations No.1 and No.2, this station should be adequate for the planning period depending on future population growth. Upgrade costs for this station were discussed in Section III.

No.4 at the end of La Brucherie by the treatment plant.

Unlike the other Gorman Rupp package lift stations within the City, this station is designed to handle large flows originating along the new La Brucherie line. As built, the station can handle a population of about 8000 which should be sufficient for the area presently considered a tributary area for this station. Future expansion south of I 8 will extend the capacity of the lift station if the City also elects to divert flows from the Imperial Ave line to the La Brucherie line. Costs for this option are also discussed in Section III.

PREVENTIVE MAINTENANCE

Engineered package lift stations are an excellent solution to servicing outlying population centers. A consistent preventive maintenance program is necessary to assure that the stations continue operating as designed. The City also has a similar lift station outside of the city limits which receives flows from the hospital and surrounding rural areas which should be serviced regularly. The existing pm schedule will have to be upgraded to include the new lift stations not presently considered part of the system.

SPARE PARTS

Due to the similarity of the package lift station, the city has the option of carrying a limited number of spare pumps, motors and parts for the maintenance of the stations. An inventory of spare parts should be on hand in order to replace defective equipment whenever necessary. This should be implemented immediately as the cost is minimal and any unnecessary down time could result in costly repairs. As the stations age and spare parts become difficult to obtain, a provision should be included within the pm program to upgrade the entire system to reflect the need for either new parts or entirely new equipment. This will become necessary as technology changes and new equipment becomes out of date as has occurred with the two main lift stations.

STAND-BY POWER CAPABILITY

None of the small lift stations presently have stand-by power. Since all the stations have similar power requirements, a portable generator would provide necessary emergency power to selected areas. Multiple stand-by power systems should not be necessary as power outages throughout the city are not common. A portable generator could be purchased at a cost of about $8,000 for a 30 KW system.

SECTION V

WASTEWATER CHARACTERISTICS

SECTION V
EL CENTRO WASTEWATER CHARACTERISTICS

Wastewater flows to the treatment plant have steadily increased since 1977. Due to an inoperative flowmeter during much of 1986, the monthly influent volume levels were estimated during that time. The actual rise from 1986 to 1987 generally follows the estimated 2.5 percent increase due to population growth, although some monthly averages have been as much as 0.5 MGD higher than the previous year. Table 6 indicates the average wastewater characteristics for the last 12 months.

WASTEWATER CHARACTERIZATION FOR EL CENTRO WWTP

DATE	FLOW MGD	INFLUENT BOD MG/L	EFFLUENT BOD MG/L	INFLUENT TSS MG/L	EFFLUENT TSS MG/L
3-1986	4.0	220	17.5	213	19.6
4-86	3.9	359	12.8	369	15.9
5-86	4.0	170	20.0	111	14.7
6-86	4.3	267	9.4	371	10.3
7-86	4.2	220	16.7	194	12.1
8-86	4.4	210	16.2	225	15.2
9-86	4.6	238	14.1	263	11.4
10-86	4.9	199	16.4	204	18.8
11-86	4.5	192	14.8	172	18.5
12-86	4.5	243	30.5	176	31.0
1-1987	4.3	214	19.0	171	21.6
2-87	4.4	270	16.6	281	17.9
TOTALS	52.1	2802	204	2750	207
AVERAGES	4.3	233	17.0	229	17.3
LB/MONTH		8374	610	8218	619

The treatment plant is presently experiencing some problems due to the age and condition of the anaerobic digester and sludge holding tank. Both tanks are currently out of service. Without the digester on line, which receives primary sludge, the primary clarifiers must be bypassed. Consequently the remaining portion of the plant has been at maximum load for some time as is indicated by the rather high effluent figures in the above table.

SECTION VI

TREATMENT PLANT CAPACITIES

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TREATMENT PLANT CAPACITIES

The 1977 Master Plan indicated that the treatment plant could serve adequately until the year 1990. Due to minor structural problems resulting from numerous earthquakes, and the desire to improve operating efficiency, some upgrading has already occurred. Further improvement to the existing facilities, to both refurbish remaining tankage and increase overall plant capacity is due forthwith. The staging plan for plant improvement will demonstrate the need to set up a revenue program to fund the required additions.

PLANT HYDRAULIC CAPACITY

Due to the relatively flat gradient surrounding the El Centro Treatment Plant, the available hydraulic head necessary for wastewater movement from one process to another is a major design consideration. The present process configuration has minor problems resulting from insufficient grade differences between tanks, particularly the secondary clarifiers. One tank receives a larger proportion of the total flow than the other during off peak periods, while peak periods sometimes result in hydraulic overloads.

Maximum hydraulic capacity of the plant is currently limited by the pumping potential of the main lift station. This limit is around 10 MGD and has been experienced during major storms. The major impact on the plant during a flow of this magnitude has been the inability of the aerated grit chamber to effectively handle the flows along with the mentioned overloading of the secondary clarifiers. As the plant has both primary and secondary clarifiers following the grit chamber, the overall impact of short term overloading of the grit chamber is minor. With future upgrades of the sewer system, such as the diverted line from Imperial to La Brucherie and installation of another 60 Hp pump within the main lift station, the plant would conceivably receive 12 MGD peaks during storms by the end of the planning period. This would be the limit the City can expect from the plant given the conduit now in use.

PLANT WATER

Secondary effluent is presently utilized for most wash down purposes within the plant and is the accepted method. The plant has adequate equipment to handle all expected needs during the planning period for available uses of effluent washdown water. The domestic water supply originates from the canal running alongside the plant. As this water is raw, drinking water must be trucked into the plant for all fresh water purposes. If the canal water source were to fail, fresh water would have to be trucked to the plant for all domestic purposes. ES2 recommends that City water be hooked into the plant as the primary water source as soon as possible with the canal water retained [illegible] back-up water source. Cost would be about $150,000 and could hopefully

be included along with other expected expansions in the Northwest section of town.

PRETREATMENT SYSTEM

The only component of the pretreatment system that actually exists on-site is the aerated grit chamber installed in 1981. The rest of the pretreatment system is located in the main lift station. The grit chamber is a well designed system capable of handling flows up to 10 MGD. It should be adequate until the year 2000. As mentioned above, peak flows of 10 MGD and higher will have a negative effect on the efficiency of the grit chamber. However, ES2 believes that this is a minor problem and does not justify the cost of expanding or replacing the grit removal system during the planning period.

PRIMARY TREATMENT SYSTEM

The primary treatment system consists of two primary clarifiers, one anaerobic digester, and one sludge holding tank. The capacities and design loading for these units and the remaining plant processes are summarized in Table 7.

STRUCTURAL INTEGRITY OF THE PRIMARY CLARIFIERS

Both tanks are old and show structural cracking and metal corrosion. This condition must be abated soon to assure continued operational capability. Due to the importance of the structural integrity of both the primary clarifiers and the digester, an independent investigation of the units has been made will result in recommended improvement and estimated costs to upgrade these units. The conclusions of that investigation will be presented in an ancillary report.

SECONDARY TREATMENT SYSTEM

The secondary treatment system has been recently upgraded to replace the mechanical aeration equipment with new fine bubble aeration systems. These are capable of transferring about twice as much the oxygen as the old system. The remaining two aeration tanks should be retrofitted with similar equipment within the next two or three years to keep pace with increasing flows. The cost for this upgrade would be about $120,000 by 1990 as the initial upgrade bid was $107,000 in 1985. With four basins operating at full efficiency, the maximum plant capacity will be reached around 1994. It should be noted that El Centro has a large wastewater temperature difference between summer and winter. Consequently, the treatment capacity of the aeration basins is not as high in the winter due to the lower water temperatures. El Centro presently has two aerobic digester basins approximately the same size as the existing activated sludge basins. These could be converted to activated sludge basins at that time. This would occur between 1994 and 1998 at present population growth rates. The cost for this upgrade would again be about $100,000 in 1986 dollars.

TABLE 7
CAPACITY OF EXISTING TREATMENT PLANT COMPONENTS

PROCESS		FLOW CAPACITY
EAST SIDE LIFT STATION		1.7 MGD WITH STANDBY
		3.0 MGD MAXIMUM FLOW
MAIN LIFT STATION		1 PUMP @ 1.7 MGD
		2 PUMPS @ 3.0 MGD
		3 PUMPS @ 4.8 MGD
		4 PUMPS @ 6.5 MGD
GRIT CHAMBER		10 MGD AVG. FLOW
PRIMARY CLARIFIERS		6.0 MGD AVG. FLOW
SURFACE LOADING		930 G/SF/D
AERATION TANKS	>>>	4.5 MGD AVG. FLOW
SOLIDS LOADING		52 LB.BOD/1000 CF/D
SECONDARY CLARIFICATION	<	6.0 MGD AVG. FLOW
SURFACE LOADING		473 G/SF/D
SOLIDS LOADING (WITH RECYCLE)		15 LB/SF/D
CHLORINE CONTACT TANK		7.0 MGD AVG. FLOW
DIGESTER (ANAEROBIC)	>>>	4.0 MGD AVG. FLOW
SOLIDS LOADING		4600 LB/D
DIGESTER (AEROBIC)		7.2 MGD AVG. FLOW
SOLIDS LOADING		3700 LB/D

SECONDARY CLARIFIERS

Normal secondary clarification loadings range between 400 and 600 gallons per day per square foot. Due to the original plant configuration and the proximity of the overall plant elevation to the El Centro water and wastewater canals, insufficient hydraulic head or slope to allow wastewater flows from the aeration basins into the secondary clarifiers in a proper manner results in surges that presently cause overloading to these units. Neither does the plant presently have the capacity to take one unit out of service to perform routine O&M without seriously overloading the other unit. ES2 recommends that a third clarifier be added to the plant before average flows exceed 5 MGD. The cost for this item is $375,000

SLUDGE THICKENING

Another process item recommended for El Centro will be a sludge thickening mechanism. Situated between the activated sludge system and the sludge digester, a thickener dewaters the secondary sludge from around a 1% solids content to a dryer sludge with a solids content from 2 to 4 % depending on the detention time and efficiency of the process. The typical process over the last 20 years has been the use of either a gravity thickener or a dissolved air floatation process. Use of such a process greatly enhances the final digestion system, with a resulting detention time increase due to the higher solids content. Consequently, less expense is required for digesters. Both of these processes require a tank and equipment with about a 20 foot diameter.

Another thickening process now available uses a belt filter press in conjunction with a polymer process to produce secondary sludges from 4 to 8 % solids content.

Costs for both type of thickening are comparable at something over $200,000. However, with the use of a large capacity belt filter press, such a press could be used for both secondary sludge thickening prior to digestion and overall sludge dewatering following digestion. This would save the cost of a separate thickening process for both sludge procedures and ES2 recommends this strategy be implemented.

CHLORINE CONTACT CHAMBER

The contact chamber is not being utilized at present as the NPDES permit does not require chlorination. The chlorine contact chamber has a volume of about 140,000 gallons. At a minimum acceptable detention time of 30 minutes, the chamber can handle peak flows up to 7 MGD. This would correspond to an average flow of about 5 MGD which would be reached around 1994. Additionally, the present chamber does not operate adequately as short-circuiting occurs which reduces the effective detention time significantly.

As EPA regulations become more stringent, some type of disinfection will be required for the effluent. As the present disinfection system

does not provide adequate detention time due to the short-circuiting of the effluent through the system, the City should plant to expand the system capacity and increase the system's effectiveness with either active or passive mixers. Due to the uncertainty of future EPA regulations, the City should plan on expanding the contact chamber no later than 1995 with an expected cost as mentioned above. Additional capacity for the next planning period would cost about $100,000.

ADDITIONAL CONSIDERATIONS

Influent and effluent gates for the existing aeration basins are presently inoperative. Process control in consequently limited to whatever the configuration of the present gate positions allow. This is not an optimal situation and must be changed to meet changing process demands. Refurbishment of the aluminum gates by replacing these with non-corroding reinforced fiberglass will assure future process control without restrictions. Concurrently, the iron gates connecting the aeration basins need repair, and the existing aerobic digester basins will require the addition of new gates to allow increased process control as future aeration basins. These operations should be completed concurrently at a total price of $55,000 and should occur no later than 1989 if not before.

SECTION VII

SLUDGE HANDLING

SECTION VII
SLUDGE HANDLING SYSTEM

PRIMARY SLUDGE DIGESTION SYSTEM

Stabilization lagoons are now being utilized for sludge storage until the digesters can be brought back into service. Assuming that the existing anaerobic digester and secondary holding tank are refurbished, the maximum capacity of this sludge system has been reached. ES2 does not agree with the Design Science Report of 1977 which states that a detention time of 14 days is adequate for proper anaerobic digestion. This leaves no room for either expansion or error and is not a recommended long-term operating strategy for El Centro.

Under the present plant operating strategy, only the primary anaerobic digester is used for the treatment of primary sludge. The secondary digester and holding tank are not utilized for digestion. If the secondary digester were to be refurbished and used as an additional primary digester, the capacity of the existing system would be adequate to treat current flows. The volume of the two digesters would be 188,000 gallons x 2 = 376,000 gallons. The hydraulic detention time, based on an estimated 14,800 gallons of primary sludge per day, would be 25.4 days. This is an acceptable figure for digestion of primary sludge and leaves some room for error or overload. The costs for the digester upgrade will be specifically addressed in a special report as requested by the city.

PRIMARY SLUDGE DEWATERING SYSTEM

The existing sludge drying beds are old and in need of replacement. As an alternative to construction of new drying beds, a belt press could be utilized for sludge dewatering. For a flow of about 15,000 gallons per day, either a one or two meter belt filter press would be more than adequate to handle present and future flows. Such a press could be incorporated into a variety of existing plant processes to solve a number of problems. Specific examples include:

a. Both the primary and secondary sludge could be dewatered to at least a 20% solids. The dewatered sludge could then be dealt with in a variety of ways including:
    1. Taken to a properly certified landfill.
    2. Incinerated by a permitted facility which could be either on-site or off-site.
    3. Hauled off-site for land application.
    4. Stored on-site for further drying and conditioning to be used for future soil cultivation or incineration.

b. With the purchase of a adequately sized unit, all flows within the planning period would be easily handled with belt press.

c. The press has an initial single belt dewatering and thickening section that could serve duty as a sludge

thickener prior to digestion following the activated sludge system. This would save the cost of either gravity and/or dissolved air floating units which cost as much as the filter press alone.

The cost for a 2 meter press which could be used for both sludge dewatering and activated sludge thickening would be about $200,000. This would include installation and the required piping to enable the press to dewater primary, secondary and activated sludges. The plant is in immediate need of such a system and the City should implement this purchase as soon as possible. The existing secondary sludge beds would remain as stand-by storage and drying area as would the ponds.

SECONDARY SLUDGE DIGESTION SYSTEM

Since the secondary treatment system was added to the original primary plant, the aerobic digestion system was designed to treat only the sludge from the secondary treatment system. As the plant is presently operating without primary clarification due to the primary digester problem, the aerobic digesters are handling higher loadings than their design anticipated.

The City has a number of options relating to which digestion system should be expended in order to handle increasing flows. ES2 recommends retrofitting the aerobic digesters into aeration basins in order to expand the activated sludge process for the following reasons:

1. The cost of retrofitting the aerobic digesters to aeration basins would be small compared to the cost of constructing new tanks plus aeration equipment for the required new activated sludge capacity.
2. Although anaerobic and aerobic digesters produce an acceptable sludge, the energy cost required to operate an aerobic system is high, and as flows increase the power costs would increase accordingly.
3. Anaerobic digestion requires a minimal amount of energy.
4. The products of anaerobic digestion are a stable sludge and waste gas which has a methane content of approximately 65% that is capable of producing on-site power.
5. Purchase of waste gas driven generators capable of cogeneration of power and heat will provide a large portion of the required power to run the plant as well as heat for the digesters. This results in a cost savings that will both pay for the cogeneration equipment and provide stand-by power capability.

Since the two existing digesters are now due for a complete refurbishment, the City should consider the option of using cogeneration to provide heat for the digestion and a large portion of the plant power requirements. These options will be considered within the digester report now in progress.

Staging of the sludge digestion change from both anaerobic and aerobic to solely anaerobic would proceed in stages as the aerobic digesters are converted to aeration basins. One aerobic digester would become an aeration basin around 1994, and the second around 1998. At the same time, the digestion load would be switched over to new anaerobic digesters capable of handling both primary and secondary sludge concurrently. Each digester will cost about $340,000 in 1986 dollars if they are built to match the present units. If generators are used to provide cogeneration capability the initial cost per digester would increase to about $400,000.

SECTION VIII

CONCRETE

SECTION VIII
EXISTING TANK CONDITION

CONCRETE REHABILITATION

Due to the age and overall climate and earthquake conditions around El Centro, most of the concrete structures show various signs of deterioration. Besides the digesters which are covered in a separate report, the two primary clarifiers all six aeration basins and numerous other concrete structures show signs of deterioration that require prompt attention. Cracks and spalling (breaking out of concrete resulting from moisture collecting around reinforcing materials causing rust and pressure within the concrete) are evident throughout the plant. Once the reinforcing steel is open to the surface, corrosion can travel along the steel into the concrete and further corrode the tank structure. The existing metal structure within the primary clarifiers are also rusting and should be refurbished. Obviously the sooner the corrosion is stopped, the easier the overall refurbishment will be.

The primary clarifiers are presently out of service due to the digester problem. This would then be the proper time to repair the concrete of the primary clarifier tanks as no impact on the plant's treatment capacity would result. Additionally, since mobilization of equipment often entails a large percentage of the overall cost of refurbishment, the other tanks should also be repaired at the same time.

Concrete refurbishment is a common process and should not present an inordinate expense for El Centro. The procedure will require cleaning the surfaces down to sound concrete and replacement of deteriorating material with an epoxy material that binds the remaining concrete together. El Centro should budget $100,000 for this project with the same priority as the digester project. The actual cost may be less depending on quotations from various manufacturers, but the cost should not exceed the above figure. In order to keep this cost in perspective, The City should realize that the tanks alone cost well over $100,000 each to replace.

SECTION IX
PROJECTED EXPANSION STAGING AND COST ESTIMATES

Staging and Cost Projections

Table 8 delineates the projected upgrades for the sewer lines and treatment facility of El Centro to the year 2000. Costs have been determined in 1986 dollars and projected forward to the year indicated by adding an annual inflation figure of 5%. Expected funding increases have also been addressed for these estimates and are included within the next section.

TABLE 8

El Centro Cost Schedule for Sewer System & Treatment System Components

Component	YEAR	ESTIMATED $	1986 $
Sewer Lines			
3rd st. from Main Street to East Side Lift Station	1990	$82,000	71,000
Along Hamilton between Imperial and La Brucherie	1994	$600,000	427,000
3rd St. between Orange and Main Street	1995	$100,000	68,000
From 4th Street to Railroad between Villa St. and Eucalyptus St.	1996	$100,000	68,000
Lift Stations			
Main Lift Station			
200 kw Generator	1988	$40,000	40,000
New Motor Control Center	1988	$32,000	32,000
Structure Refurbishment	1988	$10,000	10,000
Replace influent Valves	1988	$10,000	10,000
Automatic Bar Screen	1989	$50,000	45,000
Scrubbing & Vent system	1989	$20,000	20,000
Chlorination System	1989	$40,000	36,000
New 60 Hp pump	1986	$8,500	8,500
New East Side Lift Station	1990	$135,000	125,000
Portable Generator	1988	8,000	8,000
Treatment Plant			
Concrete Refurbishment	1986	$100,000	100,000
New clarifier	1992	$478,000	375,000
2 meter Belt Press & Sludge Thickener	1986	$200,000	200,000
New Digester	1990	$360,000	311,000
New Digester	1997	$510,000	311,000
Retrofit Aeration Tanks	1990	$120,000	107,000
Chlorine Contact Chamber	1994	$100,000	71,000
Retrofit Aerobic Digesters	1994	$150,000	107,000
Aeration Gate Retrofit	1989	$ 63,000	55,000
		$3.124.500	[illegible]

SECTION X

PROJECTED FUNDING REQUIREMENTS

SECTION X
PROJECTED FUNDING REQUIREMENTS

OPERATION AND MAINTENANCE COSTS

Yearly costs for The City of El Centro Sanitary Sewer System have been estimated at $897,762 or about $900,000. These costs as indicated by Resolution No. 86-10 dated February 5, 1986 are delineated as:

OPERATION AND MAINTENANCE EXPENSE

COLLECTION SYSTEM	$ 204,970
TREATMENT FACILITIES	356,887
REPLACEMENT COSTS	111,420
ADMINISTRATION & OVERHEAD	153,000
OPERATING RESERVE	71,485

Expenses that may be applied to Master Plan costs from the above figures include replacement costs for the treatment facility at $111,420 and the operating reserve at $71,485. The figure for replacement costs was derived by estimating replacement costs for mostly minor equipment during 1985 till 1990. The only major equipment mentioned was $75,000/yr for four years. This figure concerns aeration equipment replacement which is the only aspect of the Master Plan that is included within both the Master Plant and the Operation and Maintenance Expense resolution.

The $75,000 times 4 = $300,000 should be extracted from the replacement costs figure and applied to an overall depreciation figure. The remaining replacement cost estimate would then average out to about $51,000 per year. This figure could be added to the operating reserve account to total about $122,000 a year. This is a reasonable figure for handling contingencies for the sewer and treatment systems.

Fixed costs for the sanitary system are then 900 - 111 + 51 = about $840,000/year. The City must then add Master Plant costs for the sanitary system. These costs are as follows:

assume: 1986 dollars with a total figure of $2,610,000 from Table 8.
13 years for amortization = 13 pay periods
simple interest at 12% per year
resulting factor of .1614 x principal/year
result: $2,610,000 x 0.1614 = $421,200/yr
or $35,100 per month

Yearly costs would then have to be updated to include Master Plan expansion and replacement costs. These are:

421,200 + 840,000 = $1,261,200/year

To relate this updated figure to EDU costs with 10,630 EDU's for the City:

$1,340,340 / 10630 = $118.65 per year or $9.89 per month

ES2 recommends that the City update their funding schedule to reflect this update as a minimum figure. At the end of the planning period the plant will have reached a reasonable maximum treatment capacity beyond which the costs will begin to rise. This is a result of the age of the plant and the size of the process piping, pumps, and appurtenances that go along with the treatment processes. Following the year 2000, additional expansion options should consider costs equal to the cost of initiating a separate treatment system. A new treatment system could then be designed to be upgraded with modular units for as long as the City can reasonably expect to be operating. El Centro should begin saving for the first segment of that treatment system as soon as possible. An absolute minimum of $3,000,000 should be set aside for the year 2000 in 1986 dollars. Using the same figure of .1614 as above, $484,000 would be required per year to pay for the expected upgrade in the year 2000. This equates to an extra $3.80 per month per EDU for a total of over $13.00 per month per EDU.

A final point to consider that seems to have been ignored within the data collected by ES2; the treatment plant is definitely receiving some industrial discharge. Discharge from industrial users has a history of causing numerous problems within a treatment plant. An example of the result occurring at El Centro is the foaming that occurs within the aeration basins when the mechanical aerators are in operation. Foaming is not a normal result of municipal waste and is definite evidence that the plant is receiving waste it has not been designed for. Many treatment plants throughout the U.S. handle large volumes of industrial waste with no problem. However, they have put together programs to handle the situation, resulting in increased revenues for the plant. An additional benefit can be increased jobs in the commercial sector if the industrial program is carried out equitably. Businesses are able to foresee the scope of the program and judge for themselves whether to open doors or not depending on their expected fixed sewer costs compared to other municipalities. ES2 highly recommends that some type of industrial discharge program be instigated for the treatment facility before the plant receives a discharge that might wipe out the plant's secondary treatment capacity entirely. These programs pay for themselves when operated correctly.

Federal and State money has often been available for wastewater treatment plant upgrades and refurbishments in the past which El Centro has been able to take advantage of and thus lessen the burden on taxpayers. However, these funds have become very difficult to come by

and ES2 does not recommend that El Centro depend on this type of funding in the future. Consequently ES2 recommends that an increase of $6 per EDU be included within the City budget as soon as possible in order to assure that the financial situation is able to keep up with the expected costs delineated within this report.

CONCLUSION

El Centro's sewer and wastewater treatment systems have provided many years of useful service to the City's inhabitants. Due to the progressing age of most of the system, operation and maintenance costs will continue to rise along with increasing replacement costs. Many of the major trunk lines will have to be replaced as the City's population increases between the year 2000 and the year 2020.

The wastewater treatment system will also reach a maximum between the years 2000 and 2020. Up to now, plant upgrades usually resulted through either the optimization of a particular process, or a simple expansion of an existing process. As Table 7 shows however, much of the plant capacity reaches a maximum around 6 MGD. Further expansions will then require almost universal changes to the plant structure which will incur considerable extra expense.

Options open to the City will then include the construction of a new plant on the opposite side of the City from the present wastewater treatment plant. As the present plant's location is generally upwind of the City and any odors originating from the plant flow toward El Centro with the prevailing winds. In addition, the slope of the land favors the east side of the town, which means that future sewers traveling in that direction would not have to be as deep as the present sewer system. This is obviously a choice best left to future consideration, but ES2 recommends the addition of this option to the next master plan.

APPENDICES

A. EL CENTRO WASTEWATER CHARACTERISTICS

B. PRESENT AND PROPOSED WWTP CONFIGURATIONS

    1. 1987
    2. 1995
    3. 2000

C. COMPUTER EVALUATION OF THE WWTP.

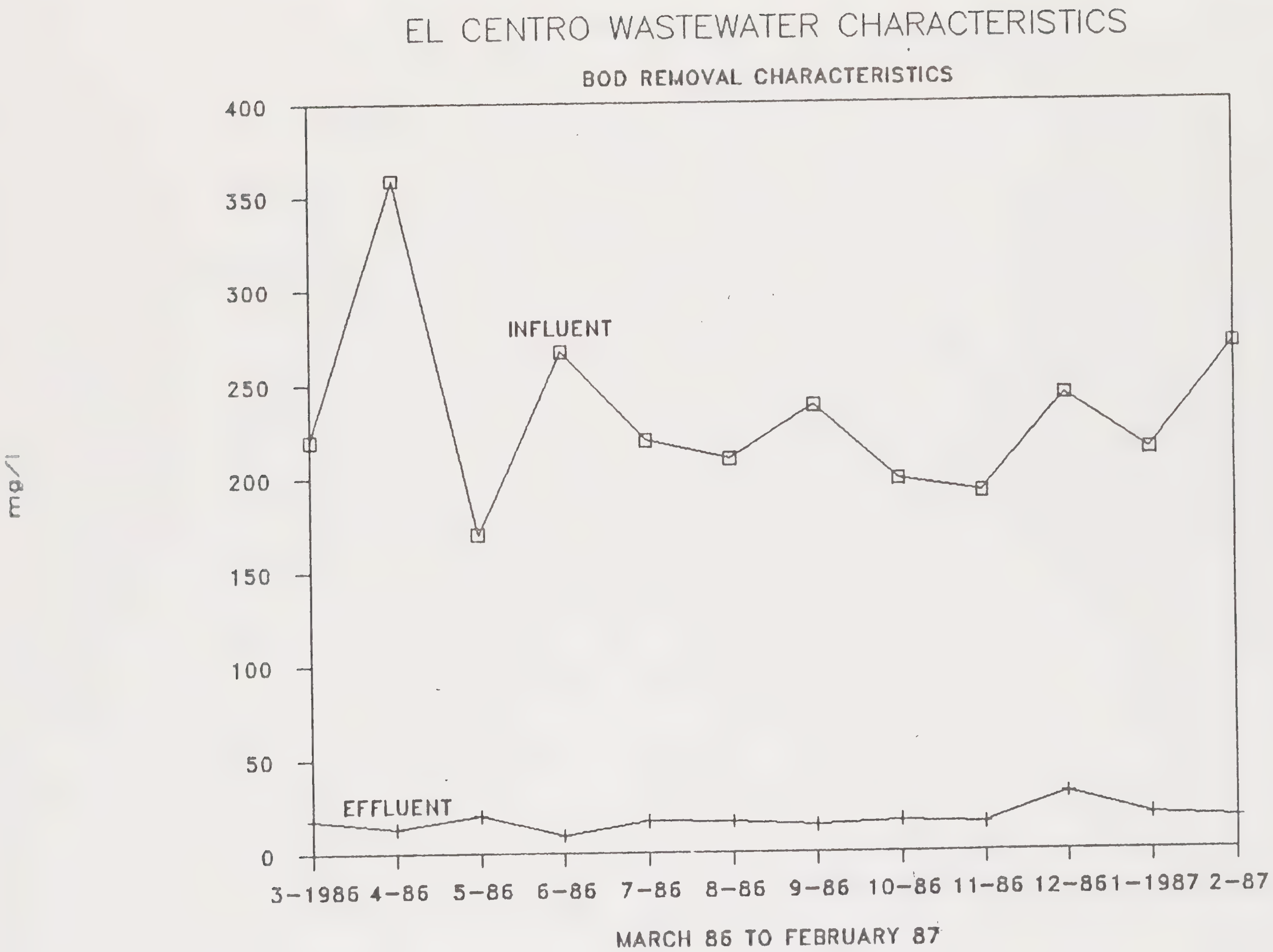
    1. 1987
    2. 1995
    3. 2000

D. COMPUTER EVALUATION OF THE CITY SEWER SYSTEM

    1. Table 2
    2. Table 3
    3. Table 4
    4. Table 5

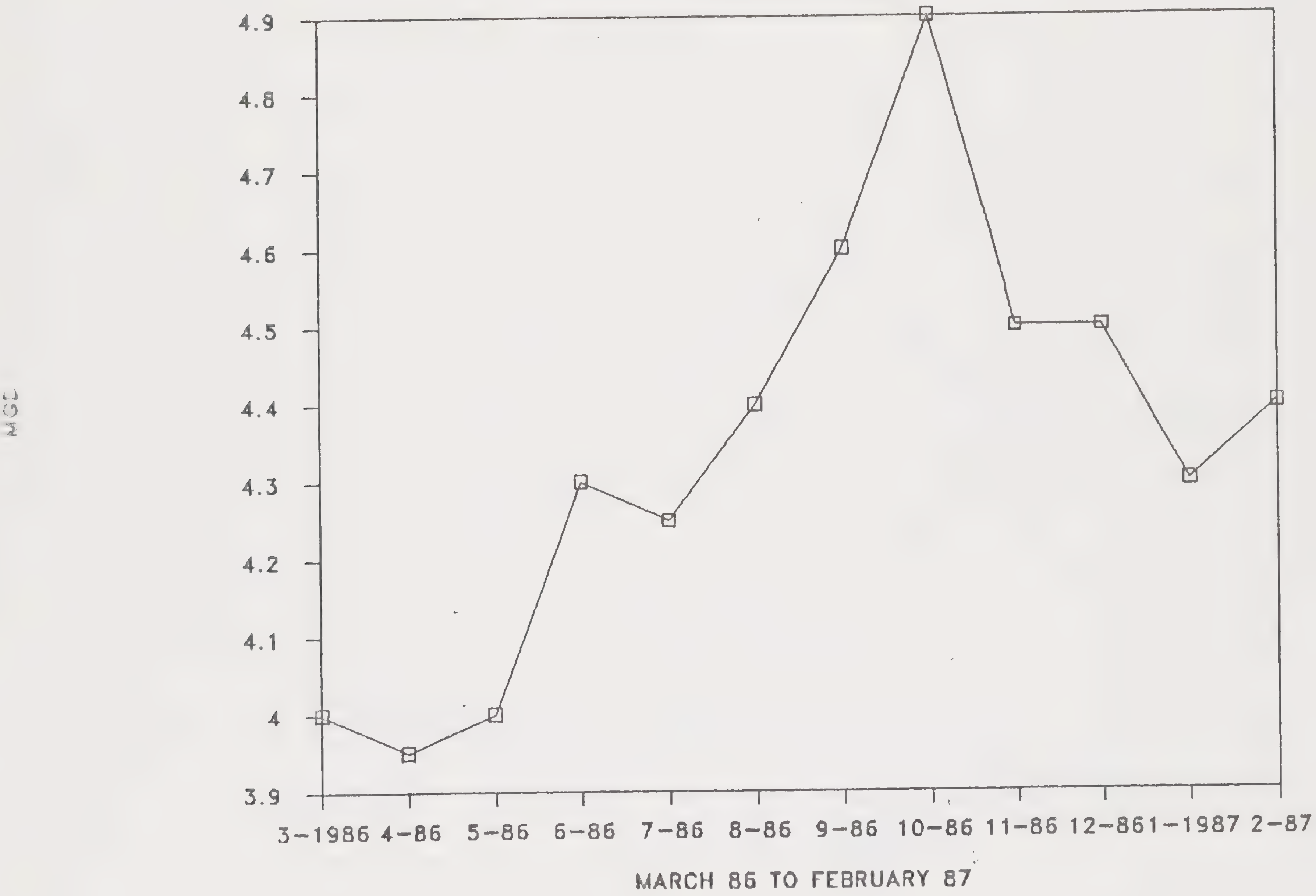
APPENDIX A

EL CENTRO WASTEWATER CHARACTERISTICS


EL CENTRO WASTEWATER CHARACTERISTICS
BOD REMOVAL CHARACTERISTICS
mg/l
400
350
300
250
200
150
100
50
0
INFLUENT
EFFLUENT
3-1986
4-86
5-86
6-86
7-86
8-86
9-86
10-86
11-86
12-86
1-1987
2-87
MARCH 86 TO FEBRUARY 87

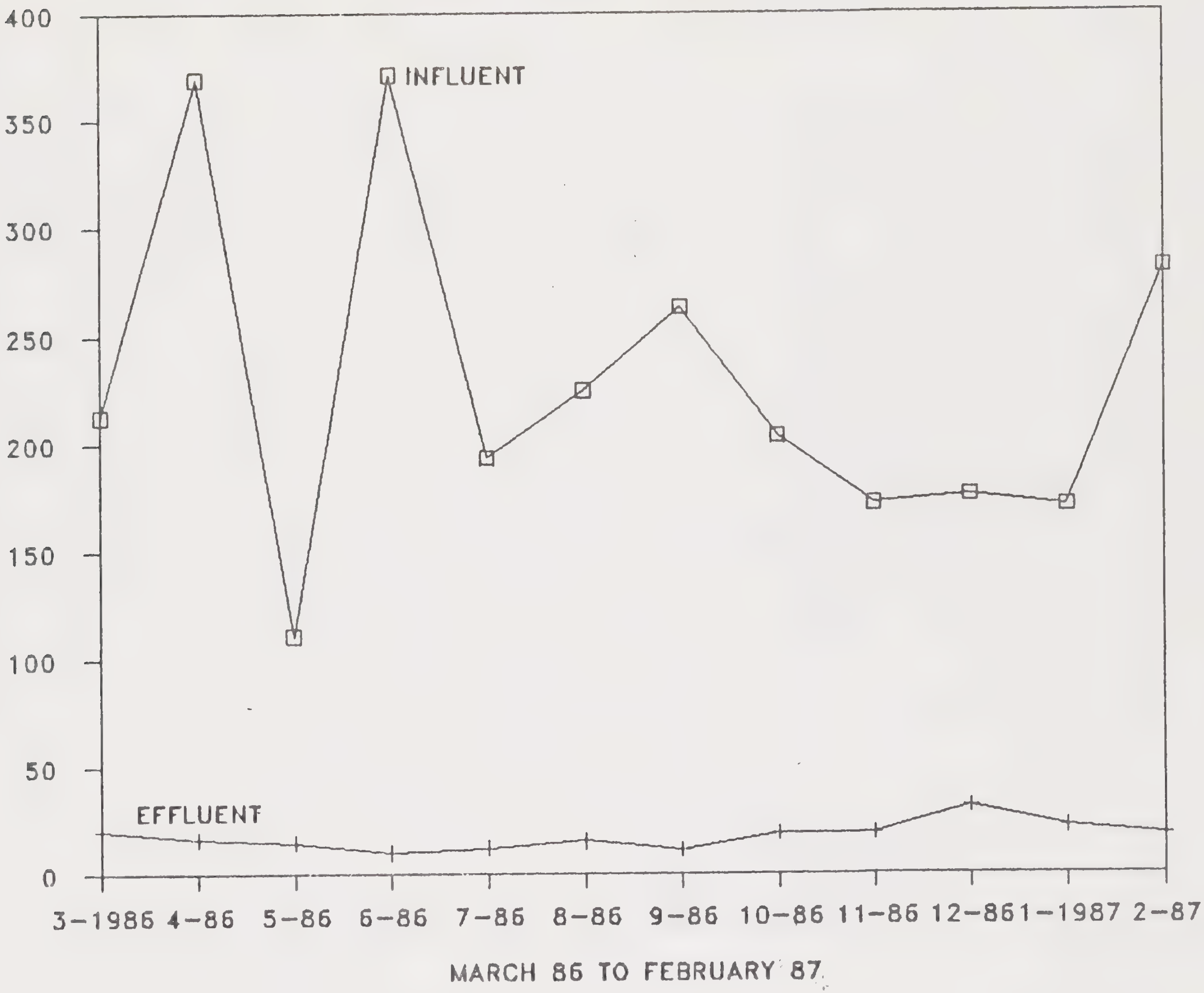
EL CENTRO WASTEWATER CHARACTERISTICS

INFLUENT FLOWS



EL CENTRO WASTEWATER CHARACTERISTICS

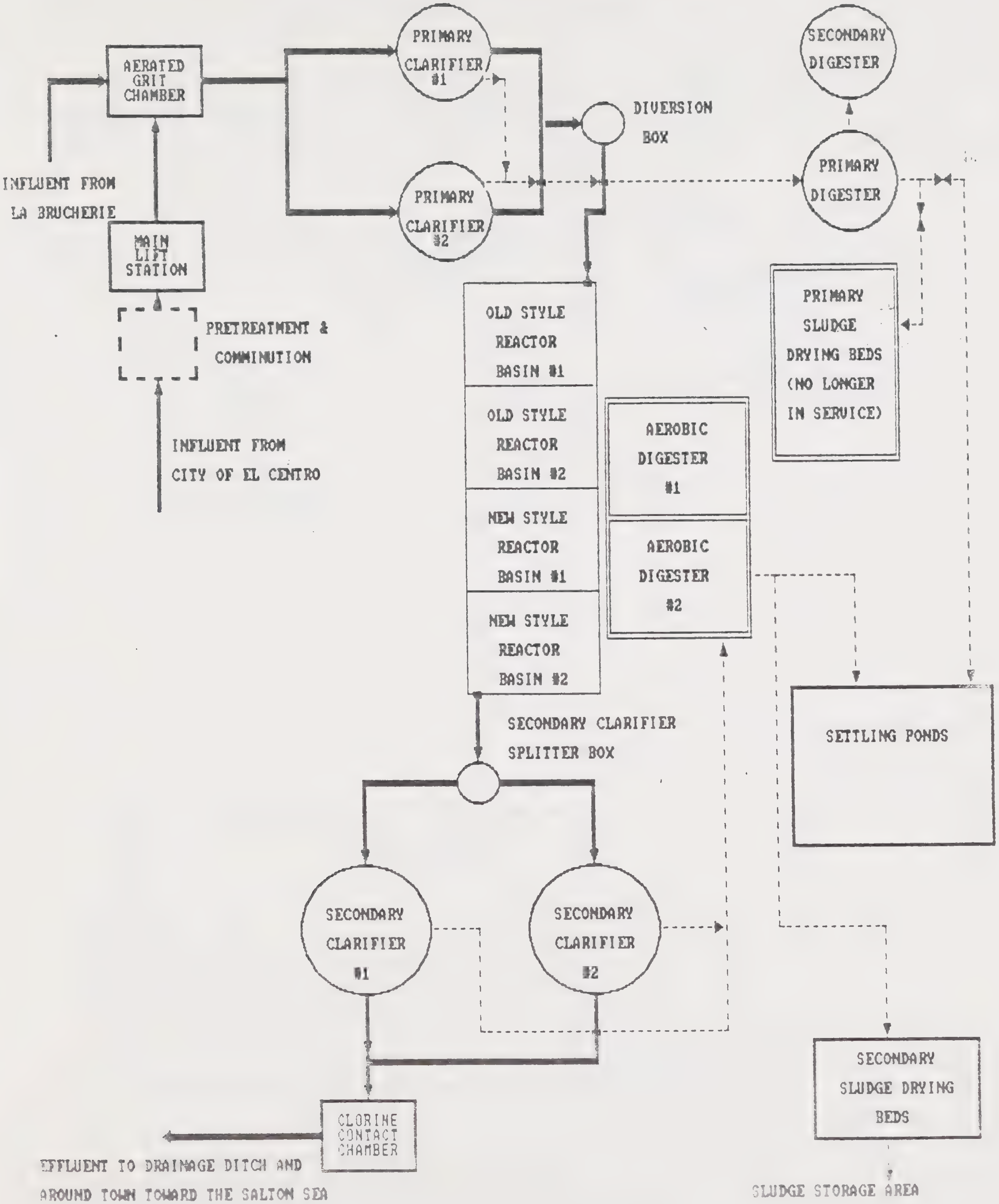
SUSPENDED SOLIDS CHARACTERIZATION



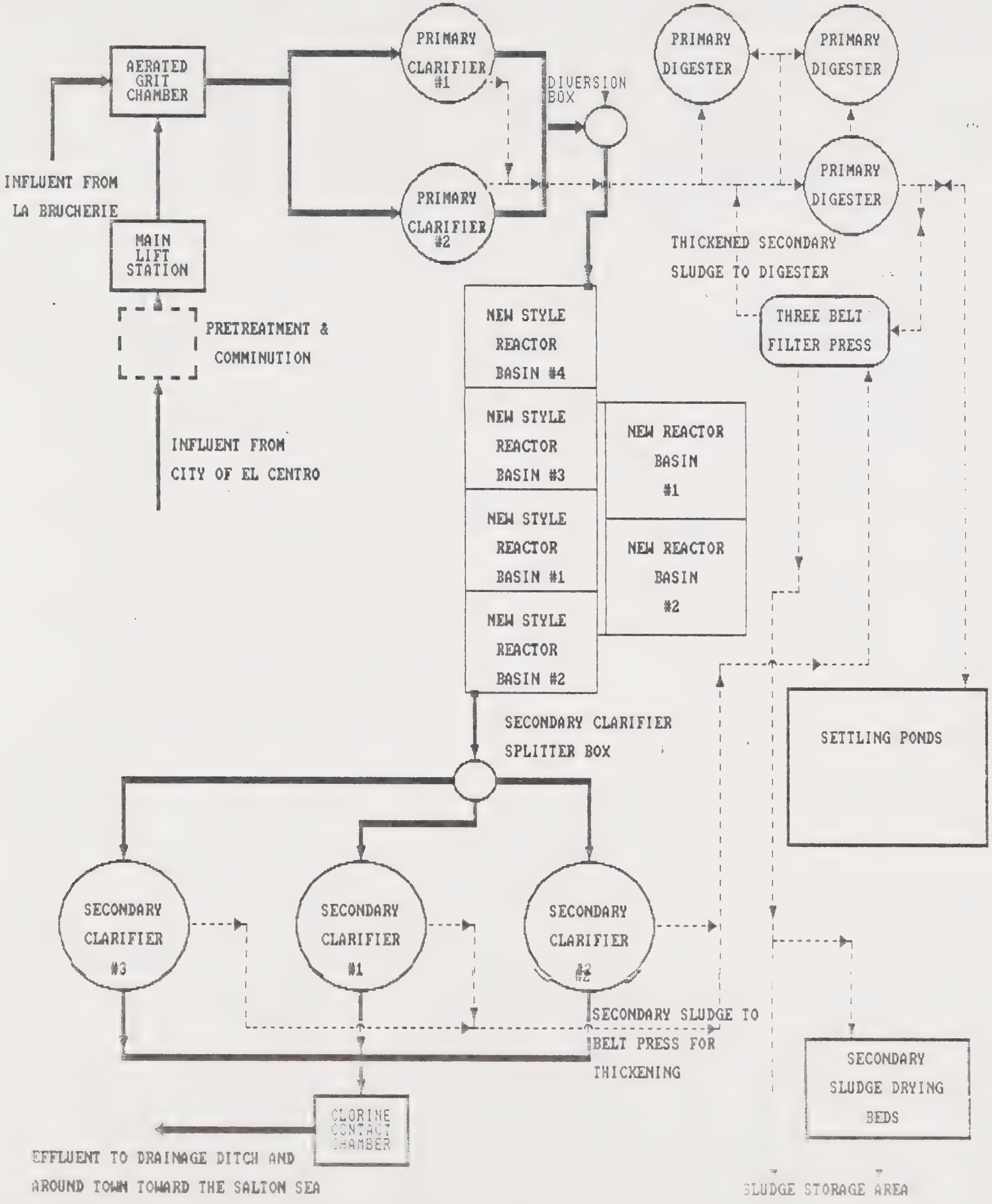
APPENDIX B

PRESENT AND PROPOSED WWTP CONFIGURATIONS

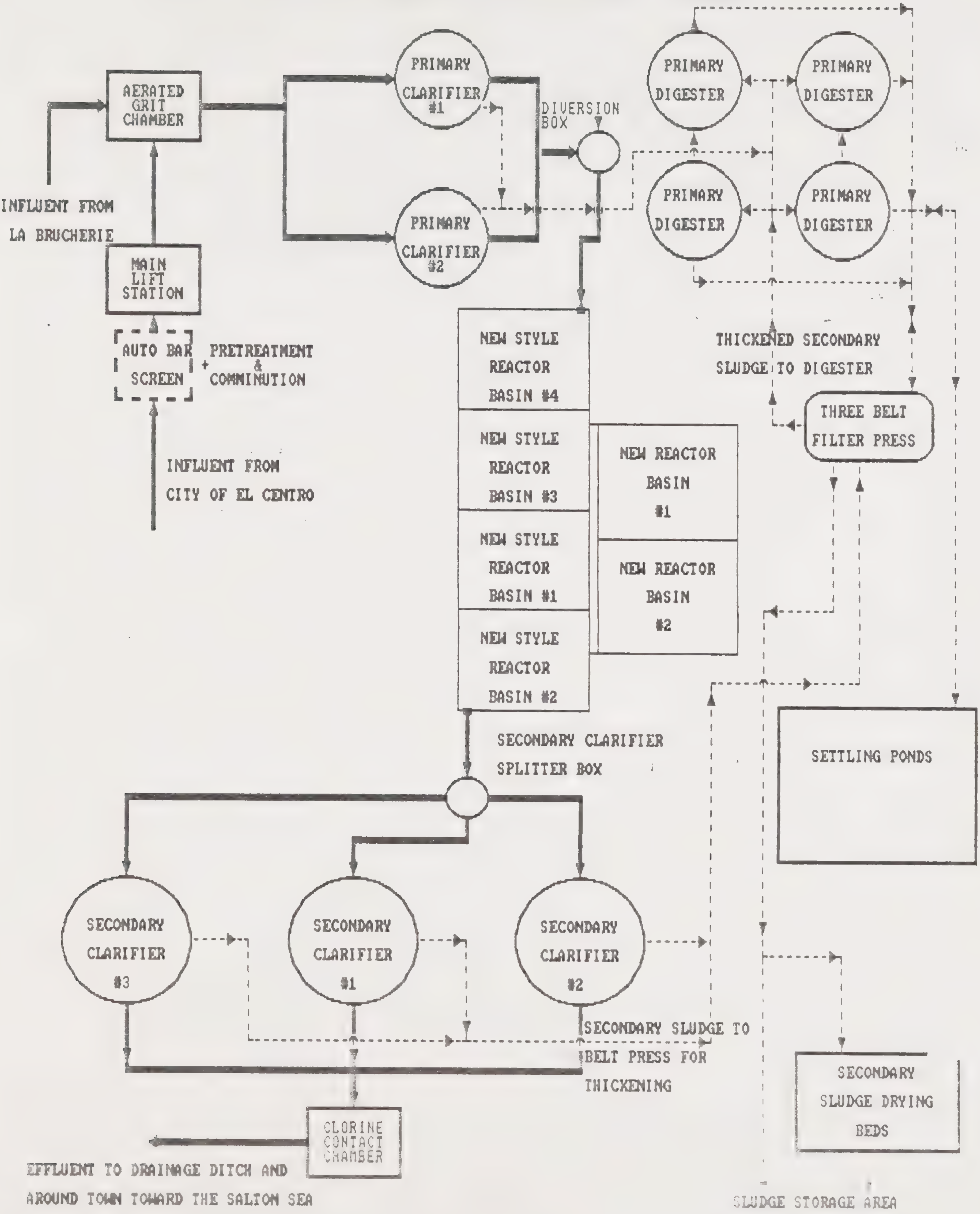
EL CENTRO WASTEWATER TREATMENT PLANT
CONFIGURATION FOR YEAR 1987



EL CENTRO WASTEWATER TREATMENT PLANT
CONFIGURATION FOR YEAR 1995



EL CENTRO WASTEWATER TREATMENT PLANT
CONFIGURATION FOR YEAR 2000



APPENDIX C

COMPUTER EVALUATION OF THE WWTP

IDEALIZED MATHEMATICAL MODEL OF EL CENTRO WWTP, CA CONVENTIONAL ACTIVATED SLUDGE WITH PRIMARY CLARIFICATION WASTEWATER TREATMENT SYSTEM

Prepared by: ES Environmental Services
by contract with Water/Wastewater Dept.
Linn Benton Community College, Albany, Oregon
Through a grant from the
Environmental Protection Agency
Seattle Washington.

[illegible]

```
                                                        DATE: 08-13-1987
                                                        TIME: 14:15

              WASTEWATER CHARACTERIZATION


          AVERAGE DRY WEATHER FLOW        MGD:  4.4
          PEAK DRY WEATHER FLOW           MGD:  6.5
          DESIGN FLOW                     MGD:  5
          INFLUENT BOD                   MG/L:  233
          INFLUENT TSS                   MG/L:  230
          INFLUENT VSS                    (%):  80 *
          TEMPERATURE                      'C:  20
          TKN                            MG/L:  30 *
          ALKALINITY                     MG/L:  100 *
          PH                                 :  7 *
          PO4-P                          MG/L:  8 *
          MAXIMUM MLSS                       :  3000
          MAXIMUM MCRT                       :  10

          *
           DEFAULT VALUE USED


      PLANT CONFIGURATION AND DIMENSIONS

          DESIGN AVERAGE DAILY FLOW (MGD)    :  5.5
          DESIGN PEAK WET WEATHER FLOW (MGD):  11


          PRIMARY CLARIFICATION
          -------------------------------------
          NUMBER OF ROUND CLARIFIERS:  2
          DIMENSIONS      EACH     TOTAL
          ----------      ----     -----
          DIAMETER   (FT):  64.0
          DEPTH      (FT):   9.00
          WEIR LTH   (FT): 200        400
          SFC AREA (FT2): 3216        6432


          TOTAL WEIR LENGTH (FT):  400
          TOTAL SURFACE AREA (FT^2):  6432
```

```
REACTORS
--------

NUMBER OF RECTANGULAR REACTORS:  4
DIMENSIONS        EACH
----------        ----
LENGTH    (FT):    45.0
WIDTH     (FT):    45.0
DEPTH     (FT):    11.0
```

```
                                                   DATE: 08-17-1987
                                                   TIME: 14:15
SECONDARY  CLARIFICATION
-------------------------------------------
NUMBER OF ROUND CLARIFIERS:  2
DIMENSIONS       EACH     TOTAL
----------       ----     -----
DIAMETER   (FT):  80.0
DEPTH      (FT):  10.00
WEIR LTH   (FT): 260       520
SFC AREA (FT2): 5026      10052


TOTAL WEIR LENGTH (FT):  520
TOTAL SURFACE AREA (FT^2):  10052



SLUDGE  HANDLING
----------------------


TYPE OF DIGESTION: ANAEROBIC


NUMBER OF PRIMARY DIGESTERS:  1
                        #1
                        ----
VOLUME       (GAL):   180000
DIGESTER HEATED         Y
DIGESTER MIXED          Y


NUMBER OF SECONDARY DIGESTERS:  1


VOLUME OF DIGESTERS # 1     (GAL):   170000
```

```
                              EL CENTRO WWTP

                                                        DATE:  08-17-1987
                                                        TIME:  14:16
                                                        BOD:   [illegible]
                                                        TSS:   235
                                                        TEMP   20

                      PRIMARY TREATMENT SYSTEM PERFORMANCE


*************************************************************************
*           *           *           *           *           *           *           *
*   FLOW    * PCE BOD   * PCE TSS   *    PS     *    PS     *    PS     *    SL     *
*   MGD     *   MG/L    *   MG/L    * LBS/DAY   *    %M     *   GPD     *  GPSFD    *
*           *           *           *           *           *           *           *
*************************************************************************

    3.30        123          92        3807        6.00        7607        513

    3.47        126          94        3922        6.00        7838        537

    3.64        128          97        4034        6.00        8061        565

    3.81        130         100        4141        6.00        8275        591

 [illegible]    132         103        4244        6.00        8480        618

 [illegible]    134         104        4344        6.00        8680        644

    4.31        136         106        4440        6.00        8873        670

    4.48        138         109        4533        6.00        9058        696

    4.65        140         111        4623        6.00        9238        722

    4.81        141         113        4710        6.00        9412        748

    4.98        143         115        4794        6.00        9580        775

    5.15        144         117        4875        6.00        9743        801

    5.32        146         118        4955        6.00        9901        827

    5.49        147         120        5031        6.00       10054        853

    5.66        148         122        5106        6.00       10203        879

    5.83        150         123        5178        6.00       10348        906

    5.99        151         125        5248        6.00       10488        932

    6.16        152         127        5317        6.00       10625        958

    6.33        153         128        5383        6.00       10757        984

    6.50        154         130        5448        6.00       10886       1010
```

EL CENTRO WWTP

DATE: 08-13-1987
TIME: 14:16
BOD: 233
TSS: 230
TEMP 20

BIOLOGICAL REACTOR PERFORMANCE, PAGE 1

FLOW MGD	MAX MLSS	MLVSS %	F/M	MCRT DAYS	SVI	RAS MGD	RAS MG/L	WAS LBS/DAY
[illegible]	2945	71	0.29	9.31	109	1.56	9193	1758
3.47	2933	72	0.31	8.48	120	1.89	8305	1923
3.64	2923	72	0.33	7.77	131	2.27	7613	2091
3.81	2172	74	0.46	5.03	183	2.52	5450	2398
3.97	1880	74	0.56	3.95	209	2.58	4775	2644
4.14	1736	75	0.64	3.37	225	2.65	4446	2866
4.31	1595	75	0.73	2.86	239	2.66	4181	3094
4.48	1593	75	0.77	2.69	244	2.85	4095	3288
4.65	1592	75	0.81	2.54	249	3.05	4019	3483
4.82	1454	76	0.93	2.17	260	2.93	3841	3723
4.99	1453	76	0.97	2.06	264	3.10	3789	3923
5.15	1453	76	1.01	1.96	267	3.27	3742	4124
5.32	1453	76	1.06	1.87	270	3.44	3700	4327
5.49	1452	76	1.10	1.78	273	3.61	3662	4532
5.66	1316	76	1.26	1.53	282	3.33	3551	4785
5.83	1316	76	1.31	1.47	284	3.47	3524	4993
5.99	1316	76	1.36	1.41	286	3.62	3498	5202
6.16	1317	76	1.40	1.35	288	3.76	3475	5412
6.33	1317	76	1.45	1.30	290	3.90	3454	5623
6.50	1317	76	1.50	1.25	291	4.04	3434	5835

```
                                 EL CENTRO WWTP

                                                               DATE:  08-13-1987
                                                               TIME:  14:16
                                                               BOD:   200
                                                               TSS:   150
                                                               TEMP:  20

                     BIOLOGICAL REACTOR PERFORMANCE, PAGE 2


*************************************************
*       *                * LOAD  *        *      *
* FLOW  *   DET   TIME   * LB BOD*  OUR   *O2 RQD.*
*  MGD  *  HRS  * DAYS   * /1000 *  MG/L  *LBS/DAY*
*       *       *        *  FT3  *  /HR   *      *
*************************************************

   3.30     4.85     0.20     38.1     24.4     3250

   3.47     4.61     0.19     40.8     25.7     3425

   3.64     4.40     0.18     43.6     27.0     3597

   3.81     4.20     0.18     46.4     25.9     3452

   3.97     4.03     0.17     49.2     25.5     3399

   4.14     3.86     0.16     52.1     25.5     3[illegible]

   4.31     3.71     0.15     55.0     25.1     [illegible]

   4.48     3.57     0.15     57.9     25.7     347[illegible]

   4.65     3.44     0.14     60.8     26.3     35[illegible]

   4.82     3.32     0.14     63.7     25.3     3380

   4.98     3.21     0.13     66.6     25.7     3426

   5.15     3.10     0.13     69.6     26.0     3464

   5.32     3.01     0.13     72.6     26.2     3493

   5.49     2.91     0.12     75.6     26.3     3513

   5.66     2.83     0.12     78.6     24.0     3206

   5.83     2.75     0.11     81.6     23.9     3185

   5.99     2.67     0.11     84.6     23.6     3154

   6.15     2.60     0.11     87.6     23.3     3111

   6.33     2.53     0.11     90.7     22.9     3056

   6.50     2.46     0.10     93.7     22.4     [illegible]
```

```
                              EL CENTRO WWTP

                                                       DATE: 06-17-1987
                                                       TIME: 14:16
                                                       VOL: [illegible]
                                                       [illegible]: [illegible]
                                                       TEMP: 20

                      SECONDARY SYSTEM PERFORMANCE


*****************************************************************************
*        *                   *                       *                                    *
* FLOW   * CLARIFIER LOAD    * SEC. SLUDGE PROD      *        TOTAL SLUDGE PROD           *
* MGD    *  SFC    * WEIR    * LBS TSS  * LBS VSS * LBS TSS * LBS VSS * % SOL   * GPD     *
*        * GPSFD   * GPLFD   *          *         *         *         *         *         *
*****************************************************************************

  3.30     328       6346       1758       1253       5565       4299      3.73  17902

  3.47     345       6673       1924       1378       5847       4516      3.67  [illegible]

  3.64  [illegible]  7000       2094       1505       6130    [illegible] [illegible] [illegible]

  3.81  [illegible] [illegible] 2407    [illegible] [illegible]  5085   [illegible] [illegible]

  3.97     395       7634       2640       1966       6882       5359      3.43  [illegible]

[illegible] 412      7961       2864       2144       7206       5618   [illegible] [illegible]

  4.31     429       8288       3094       2328       7533       5880      3.33  27137

  4.48     446       8615       3289       2477       7822       6104   [illegible] [illegible]

  4.65  [illegible]  8942       3466    [illegible] [illegible] [illegible] [illegible] [illegible]

  4.82     479       9269       3728       2821       8439       6590      3.22  31450

  4.98     496       9576       3918       2965       8709       6799      3.19  32754

  5.15     512       9903       4121       3120       8995       7020      3.16  [illegible]

[illegible] 529     10230       4326       3276       9280       7239      3.13  35517

  5.49     546      10557       4533       3457       9564       7458      3.11  [illegible]

  5.66     563      10884       4788       3638       9894       7723      3.08  [illegible]

  5.83     580      11211       4997       3797      10177       7940      3.05  [illegible]

  5.99     596      11519       5196       3947      10442       8144      3.03  [illegible]

  6.16     613      11846       5408       4108      10723       8360      3.01  42701

[illegible] 630   [illegible] [illegible]  4269    [illegible] [illegible] [illegible] [illegible]

  6.50     647      12500       5835       4431      11283       8789      2.97  45518
```

EL CENTRO WWTP

DATE: 08-13-1987
TIME: 14:16

DIGESTER PERFORMANCE
ANAEROBIC

BOD: 233
TSS: 230
TEMP 20

PRIMARY DIGESTER VOLUME (GAL): 188000

PLANT FLOW MGD	TOTAL SLUDGE FLOW GPD	VSS LOADING LB/FT3/ DAY	MCRT DAYS	% VSS RED.	ALK. MG/L	GAS PRO. FT3/ DAY	% SOL DIG. SLUDGE
3.30	17902	0.2	11	34.4	3354	22201	2.76
[illegible]	[illegible]	0.2	10	33.0	3200	[illegible]	[illegible]
[illegible]	[illegible]	0.2	9	31.6	3247	22426	2.73
3.81	22423	0.2	8	29.5	3151	22533	2.72
3.97	24033	0.2	8	28.1	3090	22601	2.70
4.14	25568	0.2	7	26.9	3042	22654	2.69
4.31	27133	0.2	7	25.7	2996	22693	2.68
4.48	28485	0.2	7	24.8	2963	22716	2.67
4.65	29843	0.3	6	24.0	2933	22731	2.67
4.81	31460	0.3	6	23.0	2895	22742	2.65
4.98	32754	0.3	6	22.3	2869	22742	2.65
[illegible]	[illegible]	0.3	6	21.6	2844	22736	2.64
5.32	35517	0.3	5	20.9	2820	22725	2.63
5.49	36905	0.3	5	20.3	2797	22710	2.63
5.66	38579	0.3	5	19.6	2768	22696	2.62
5.83	39978	0.3	5	19.0	2747	22674	2.61
5.99	41277	0.3	5	18.5	2729	22651	2.60
[illegible]	[illegible]	0.3	4	18.0	2710	22624	2.60
6.33	44109	0.3	4	17.6	2692	22596	2.59

IDEALIZED MATHEMATICAL MODEL OF
EL CENTRO WASTEWATER TREATMENT PLANT

CONVENTIONAL ACTIVATED SLUDGE
WITH PRIMARY CLARIFICATION
WASTEWATER TREATMENT SYSTEM

Prepared by: ES Environmental Services
by contract with Water/Wastewater Dept.
Linn Benton Community College, Albany, Oregon
Through a grant from the
Environmental Protection Agency
Seattle Washington.

```
                                                              DATE: 08-13-1987
                                                              TIME: 13:59
```

WASTEWATER CHARACTERIZATION

```
AVERAGE DRY WEATHER FLOW      MGD:  5
PEAK WET WEATHER FLOW         MGD:  10
DESIGN FLOW                   MGD:  5
INFLUENT BOD                 MG/L:  233
INFLUENT TSS                 MG/L:  230
INFLUENT VSS                  (%):  80 *
TEMPERATURE                   'C:   20
TKN                          MG/L:  30 *
ALKALINITY                   MG/L:  100 *
PH                              :   7 *
PO4-P                        MG/L:  8 *
MAXIMUM MLSS                    :   3000
MAXIMUM MCRT                    :   10

*
 DEFAULT VALUE USED
```

PLANT CONFIGURATION AND DIMENSIONS

```
DESIGN AVERAGE DAILY FLOW (MGD)    :  5
DESIGN PEAK WET WEATHER FLOW (MGD):  10
```

PRIMARY CLARIFICATION

```
-------------------------------------------
NUMBER OF ROUND CLARIFIERS:  2
DIMENSIONS          EACH     TOTAL
----------          ----     -----
DIAMETER  (FT):   64.0
DEPTH     (FT):    9.00
WEIR LTH  (FT): 200         400
SFC AREA (FT2): 3216         6432


TOTAL WEIR LENGTH (FT):  400
TOTAL SURFACE AREA (FT^2):  6432
```

```
REACTORS
--------
NUMBER OF RECTANGULAR REACTORS:  4
DIMENSIONS       EACH
----------       ----
LENGTH    (FT):    45.0
WIDTH     (FT):    45.0
DEPTH     (FT):    11.0
```

```
                                                          DATE: 02-12-1987
                                                          TIME: 13:59
       SECONDARY  CLARIFICATION
       ----------------------------------------------
       NUMBER OF ROUND CLARIFIERS:  2
       DIMENSIONS       EACH     TOTAL
       ----------       ----     -----
       DIAMETER  (FT):  80.0
       DEPTH     (FT):  10.00
       WEIR LTH  (FT): 260        520
       SFC AREA (FT2): 5026       10052


       TOTAL WEIR LENGTH (FT):  520
       TOTAL SURFACE AREA (FT^2):  10052



       SLUDGE  HANDLING
       ------------------------------


       SLUDGE THICKENING              : YES
       TYPE                           : GRAVITY BELT


       TYPE OF DIGESTION: ANAEROBIC


       NUMBER OF PRIMARY DIGESTERS:  3
                               #1       #2       #3
                               ----     ----     ----
       VOLUME      (GAL):   188000   188000   188000
       DIGESTER HEATED         Y        Y         Y
       DIGESTER MIXED          Y         Y          Y
```

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-13-1987
TIME: 14:00
BOD: 233
TSS: 230
TEMP 20

PRIMARY TREATMENT SYSTEM PERFORMANCE

FLOW MGD	PCE BOD MG/L	PCE TSS MG/L	PS LBS/DAY	PS %M	PS GPD	SL GPSFD
3.75	130	99	4106	6.00	8205	583
3.89	131	101	4196	6.00	8385	605
4.04	133	103	4283	6.00	8560	628
4.18	135	105	4368	6.00	8729	650
4.33	136	107	4450	6.00	8893	673
4.47	138	109	4530	6.00	9053	695
4.62	139	110	4608	6.00	9208	718
4.76	141	112	4683	6.00	9356	740
4.91	142	114	4755	6.00	9505	763
5.05	143	115	4827	6.00	9647	785
5.20	145	117	4897	6.00	9786	808
5.34	146	119	4964	6.00	9921	830
5.49	147	120	5030	6.00	10052	853
5.63	148	122	5094	6.00	10180	875
5.78	149	123	5157	6.00	10305	898
5.92	150	124	5218	6.00	10427	920
6.07	151	126	5277	6.00	10546	943
6.21	152	127	5335	6.00	10662	965
6.36	153	128	5392	6.00	10776	988
6.50	154	130	5448	6.00	10886	1010

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-13-1987
TIME: 14:00
FLO: 277
TSS: 270
TEMP: 20

BIOLOGICAL REACTOR PERFORMANCE, PAGE 1

FLOW MGD	MAX MLSS	MLVSS %	F/M	MCRT DAYS	SVI	RAS MGD	RAS MG/L	WAS LBS/DAY
3.75	2020	73	0.43	5.58	172	2.48	5827	2311
3.89	2025	74	0.51	4.46	197	2.58	5079	2525
4.04	1975	74	0.58	3.84	212	2.68	4713	[illegible]
4.19	1736	75	0.65	3.31	226	2.71	4416	2914
[illegible]	1674	76	0.74	2.84	240	[illegible]	4171	[illegible]
4.47	1592	75	0.77	2.70	244	2.85	4097	[illegible]
4.62	1507	75	0.80	2.57	249	[illegible]	4031	3449
4.76	1454	76	0.91	2.21	259	2.88	3858	3660
4.91	1453	76	0.95	2.11	261	[illegible]	3812	3831
5.05	1453	76	0.99	2.02	265	3.17	3769	4004
5.20	1453	76	1.03	1.93	268	3.31	3731	4178
5.34	1453	76	1.06	1.85	271	3.46	3695	4353
5.49	1452	76	1.10	1.78	273	3.61	3663	4529
5.63	1452	76	1.14	1.72	275	3.75	3633	4706
5.78	1316	76	1.29	1.48	283	3.43	3532	4933
5.92	1316	76	1.33	1.43	285	3.55	3509	5110
6.07	1316	76	1.38	1.38	287	3.68	3488	5290
6.21	1317	75	1.42	1.34	288	3.80	3469	5471
6.36	[illegible]	[illegible]	[illegible]	[illegible]	290	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-17-1987
TIME: 14:00
BOD: 200
TSS: 230
TEMP 20

BIOLOGICAL REACTOR PERFORMANCE, PAGE 2

FLOW MGD	DET TIME		LOAD LB BOD /1000 FT3	OUR MG/L /HR	O2 RQD. LBS/DAY
	HRS	DAYS			
3.75	4.27	0.18	45.5	26.0	3468
3.89	4.11	0.17	47.9	25.7	3425
4.04	3.96	0.16	50.3	25.7	3428
4.18	3.82	0.16	52.8	25.5	3401
4.33	3.69	0.15	55.3	25.0	[illegible]
4.47	3.58	0.15	57.8	25.5	3406
4.62	3.46	0.14	60.3	26.0	3468
4.76	3.36	0.14	62.8	25.0	3324
4.91	3.26	0.14	65.3	25.2	3368
5.05	3.17	0.13	67.8	25.5	3401
5.20	3.08	0.13	70.4	25.7	3427
5.34	2.99	0.12	72.9	25.8	3447
5.49	2.92	0.12	75.5	25.9	3460
5.63	2.84	0.12	78.1	26.0	3465
5.78	2.77	0.12	80.7	23.4	3124
5.92	2.70	0.11	83.3	23.2	3096
6.07	2.64	0.11	85.9	22.9	3059
6.21	2.58	0.11	88.5	22.6	3013
6.36	2.52	0.10	91.1	22.2	[illegible]
6.50	2.46	0.10	93.7	21.7	[illegible]

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-12-1987
TIME: 14:00
BOD: 233
TSS: 220
TEMP 20

FINAL CLARIFIER PERFORMANCE AND EFFLUENT CHARACTERISTICS

FLOW MGD	DET. TIME HRS.	DOB FT	EFF BOD MG/L	EFF TSS MG/L	EFF NH3 MG/L	EFF NO3 MG/L	EFF PO4-P MG/L
3.75	4.8	6.02	12	16	25.9	<1.0	4.7
3.89	4.6	6.01	16	21	25.7	<1.0	4.7
4.04	4.5	6.01	18	24	25.6	<1.0	4.7
4.18	4.3	6.07	22	28	25.4	<1.0	4.6
4.33	4.2	6.18	25	33	25.3	<1.0	4.6
4.47	4.0	6.11	27	35	25.2	<1.0	4.6
4.62	3.9	6.05	28	37	25.1	<1.0	4.6
4.76	3.8	6.23	33	44	24.9	<1.0	4.5
4.91	3.7	6.19	34	47	24.9	<1.0	4.5
5.05	3.6	6.15	36	49	24.8	<1.0	4.5
5.20	3.5	6.11	37	52	24.7	<1.0	4.5
5.34	3.4	6.07	39	55	24.6	<1.0	4.5
5.49	3.3	6.03	41	57	24.6	<1.0	4.5
5.63	3.2	6.00	43	60	24.5	<1.0	4.4
5.78	3.1	6.27	49	70	24.4	<1.0	4.4
5.92	3.0	6.25	51	74	24.3	<1.0	4.4
6.07	3.0	6.23	53	77	24.2	<1.0	4.4
6.21	2.9	6.20	55	81	24.2	<1.0	4.4
6.36	2.8	6.18	57	84	24.1	<1.0	4.[illegible]
6.50	2.8	6.17	59	88	24.1	<1.0	

```
                    EL CENTRO WASTEWATER TREATMENT PLANT
                                                        DATE: 08-13-1987
                                                        TIME: 14:00
                                                        BOD:  235
                                                        TSS:  230
                                                        TEMP  20
                      SECONDARY SYSTEM PERFORMANCE


*****************************************************************************
*      *                  *                                                  *
* FLOW * CLARIFIER LOAD * SEC. SLUDGE PROD *       TOTAL SLUDGE PROD         *
* MGD  *   SFC   * WEIR  * LBS TSS * LBS VSS* LBS TSS * LBS VSS * % SOL * GPD *
*      * GPSFD   * GPLFD *         *        *         *         *       *     *
*****************************************************************************

  3.75    373     7211     2311     1693     6417     4978    3.53  21794
  3.89    387     7480     2520     1867     6713     5221    3.47  23219
  4.04    402     7769     2717     2024     7001     5451    3.42  24576
  4.18    416     8038     2909     2178     7274     5671    3.37  25682
  4.33    431     8326     3117     2346     7567     5906    3.32  27292
  4.47    445     8596     3277     2468     7805     6090    3.29  28405
  4.62    460     8884     3451     2600     8060     6287    3.26  29603
  4.76    473     9153     3657     2767     8338     6512    3.23  30976
  4.91    488     9442     3834     2902     8591     6708    3.20  32187
  5.05    502     9711     4001     3029     8827     6890    3.18  33321
  5.20    517    10000     4181     3166     9079     7084    3.15  34540
  5.34    531    10269     4350     3294     9314     7265    3.13  35680
  5.49    546    10557     4533     3433     9564     7458    3.11  36905
  5.63    560    10826     4704     3563     9797     7638    3.09  38051
  5.78    575    11115     4936     3750    10094     7876    3.06  39566
  5.92    589    11384     5109     3881    10326     8055    3.04  40719
  6.07    604    11673     5296     4023    10575     8246    3.02  41958
  6.21    618    11942     5471     4155    10806     8425    3.01  43115
  6.36    633    12230     5659     4298    11053     8613    2.99  44357
  6.50    647    12500     5835     4431    11283     8789    2.97  45518
```

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-17-1997
TIME: 14:00

DIGESTER PERFORMANCE
ANAEROBIC

BOD: [illegible]
TSS: [illegible]
TEMP [illegible]

PRIMARY DIGESTER VOLUME (GAL): 564000

PLANT FLOW MGD	TOTAL SLUDGE FLOW GPD	VSS LOADING LB/FT3/DAY	MCRT DAYS	% VSS RED.	ALK. MG/L	GAS PRO. FT3/DAY	% SOL DIG. SLUDGE
3.75	21794	0.1	26	56.4	3177	42119	2.02
[illegible]	[illegible]	0.1	24	54.8	3120	[illegible]	[illegible]
[illegible]	24576	0.1	23	[illegible]	3074	[illegible]	2.02
4.16	[illegible]	0.1	22	[illegible]	[illegible]	44554	2.03
[illegible]	[illegible]	0.1	21	[illegible]	[illegible]	[illegible]	[illegible]
4.47	23405	0.1	20	49.9	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	0.1	19	[illegible]	[illegible]	46009	2.05
[illegible]	[illegible]	0.1	18	[illegible]	2905	[illegible]	[illegible]
4.91	[illegible]	0.1	18	[illegible]	[illegible]	[illegible]	2.06
[illegible]	[illegible]	0.1	17	45.8	2859	[illegible]	2.06
[illegible]	[illegible]	0.1	16	44.9	2837	47763	2.07
[illegible]	[illegible]	0.1	16	44.1	2817	48108	2.07
5.49	36905	0.1	15	43.3	2797	48456	2.08
5.63	38051	0.1	15	42.6	2779	48764	2.08
5.79	39566	0.1	14	41.6	2753	49166	2.09
5.92	40719	0.1	14	40.9	2737	49439	2.09
[illegible]	41958	0.1	13	40.2	2720	49717	2.09
[illegible]	[illegible]	0.1	13	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

IDEALIZED MATHEMATICAL MODEL OF
EL CENTRO WASTEWATER TREATMENT PLANT

CONVENTIONAL ACTIVATED SLUDGE
WITH PRIMARY CLARIFICATION
WASTEWATER TREATMENT SYSTEM

Prepared by: ES Environmental Services
by contract with Water/Wastewater Dept.
Linn Benton Community College, Albany, Oregon
Through a grant from the
Environmental Protection Agency
Seattle Washington.

[illegible]
[illegible]

```
                                                              DATE: 08-13-1987
                                                              TIME: 13:32

                WASTEWATER CHARACTERIZATION


            AVERAGE DRY WEATHER FLOW        MGD:  6
            PEAK DRY WEATHER FLOW           MGD:  12
            DESIGN FLOW                     MGD:  6
            INFLUENT BOD                   MG/L:  235
            INFLUENT TSS                   MG/L:  230
            INFLUENT VSS                    (%):  80 *
            TEMPERATURE                      'C:  20
            TKN                            MG/L:  30 *
            ALKALINITY                     MG/L:  100 *
            PH                                 :  7 *
            PO4-P                          MG/L:  8 *
            MAXIMUM MLSS                       :  3000
            MAXIMUM MCRT                       :  10

            *
             DEFAULT VALUE USED


        PLANT CONFIGURATION AND DIMENSIONS

            DESIGN AVERAGE DAILY FLOW (MGD)    :  6
            DESIGN PEAK WET WEATHER FLOW (MGD):  12


            PRIMARY CLARIFICATION
            ---------------------------------------------
            NUMBER OF ROUND CLARIFIERS:  2
            DIMENSIONS        EACH     TOTAL
            ----------        ----     -----
            DIAMETER   (FT):   64.0
            DEPTH      (FT):    9.00
            WEIR LTH   (FT): 200        400
            SFC AREA (FT2): 3216        6432



            TOTAL WEIR LENGTH (FT):  400
            TOTAL SURFACE AREA (FT^2):  6432
```

```
REACTORS
--------
NUMBER OF RECTANGULAR REACTORS:  6
DIMENSIONS       EACH
----------       ----
LENGTH    (FT):    45.0
WIDTH     (FT):    45.0
DEPTH     (FT):    11.0
```

```
                                                                    DATE: 08-13-1987
                                                                    TIME: 13:32
              SECONDARY  CLARIFICATION
              ------------------------------------------------------
              NUMBER OF ROUND CLARIFIERS:  2
              DIMENSIONS       EACH     TOTAL
              ----------       ----     -----
              DIAMETER  (FT):   80.0
              DEPTH     (FT):   10.00
              WEIR LGTH (FT): 260        520
              SFC AREA (FT2): 5026      10052


              TOTAL WEIR LENGTH (FT):  520
              TOTAL SURFACE AREA (FT^2):  10052



              SLUDGE  HANDLING
              -----------------------------------


              SLUDGE THICKENING                  : YES
              TYPE                               : GRAVITY BELT

              TYPE OF DIGESTION: ANAEROBIC

              NUMBER OF PRIMARY DIGESTERS:  4
                                  #1       #2       #3       #4
                                  ----     ----     ----     ----
              VOLUME     (GAL):  188000   188000   188000   188000
              DIGESTER HEATED     Y         Y         Y         Y
              DIGESTER MIXED      Y          Y          Y          Y
```

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-13-1987
TIME: 13:[illegible]
BOD: [illegible]
TSS: [illegible]
TEMP 20

PRIMARY TREATMENT SYSTEM PERFORMANCE

FLOW MGD	PCE BOD MG/L	PCE TSS MG/L	PS LBS/DAY	PS %M	PS GPD	SL GPSFD
4.50	139	109	4544	6.00	9081	699
4.67	140	111	4637	6.00	9266	726
4.85	142	113	4726	6.00	9444	753
5.07	143	115	4812	6.00	9616	780
5.19	145	117	4895	6.00	9783	807
5.37	146	119	4976	6.00	9945	834
5.54	147	121	5055	6.00	10101	861
[illegible]	148	122	5131	6.00	10253	888
5.89	150	124	5205	6.00	10401	915
6.06	151	126	5276	6.00	10544	942
6.24	152	127	5346	6.00	10683	969
6.41	153	129	5413	6.00	10818	996
6.58	155	130	5479	6.00	10950	1023
6.76	156	132	5543	6.00	11078	1050
6.93	157	133	5606	6.00	11202	1077
7.11	157	134	5666	6.00	11323	1104
7.28	158	136	5723	6.00	11442	1131
7.45	159	137	5783	6.00	11557	1158
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

EL CENTRO WASTEWATER TREATMENT PLANT

DATE: 08-13-1987
TIME: 13:33
BOD: [illegible]
TSS: [illegible]
TEMP [illegible]

BIOLOGICAL REACTOR PERFORMANCE, PAGE 1

FLOW MGD	MAX MLSS	MLVSS %	F/M	MCRT DAYS	SVI	RAS MGD	RAS MG/L	WAS LBS/DAY
4.50	2990	70	0.30	9.07	112	2.26	8931	2747
4.67	2981	70	0.31	8.48	120	2.62	8707	2930
4.85	2972	71	0.33	7.95	128	2.99	7788	3116
5.02	2357	72	0.42	5.68	170	3.34	5979	3457
5.19	2057	73	0.50	4.58	194	3.45	5150	3746
5.37	1909	73	0.56	3.99	209	3.55	4793	3992
5.54	1762	74	0.63	3.46	223	3.58	4494	4052
5.72	1761	74	0.65	3.29	227	3.81	4405	4459
5.89	1617	74	0.74	2.85	240	3.72	4175	4725
6.06	1616	74	0.76	2.73	243	3.92	4113	4936
6.24	1615	74	0.79	2.62	247	4.13	4056	5148
6.41	1474	75	0.89	2.27	257	3.92	3886	5424
6.58	1474	75	0.93	2.18	260	4.09	3845	5640
6.76	1473	75	0.96	2.10	263	4.27	3807	5857
6.93	1473	75	0.99	2.02	265	4.44	3772	6075
7.11	1473	75	1.02	1.95	267	4.62	3739	6294
7.28	1472	75	1.05	1.88	270	4.79	3709	6511
7.45	1472	75	1.08	[illegible]	272	[illegible]	3681	[illegible]
.63	1334	75	1.22	1.58	280	4.54	3575	7024
.80	1334	75	1.26	[illegible]	281	[illegible]	[illegible]	[illegible]

```
                    EL CENTRO WASTEWATER TREATMENT PLANT
                                                         DATE: 08-13-1987
                                                         TIME: 17:[illegible]
                                                         BOD:  [illegible]
                                                         TSS:  [illegible]
                                                         TEMP  [illegible]

                 BIOLOGICAL REACTOR PERFORMANCE, PAGE 2


**************************************************
*         *                *  LOAD  *       *          *
* FLOW    *    DET   TIME  * LB BOD*  OUR   *O2 ROD.*
*  MGD    *   HRS  * DAYS  * /1000 *  MG/L  *LBS/DAY*
*         *        *       *  FT3  *  /HR   *          *
**************************************************

    4.50      5.33      0.22      38.8      24.7      4949

    4.67      5.13      0.21      40.8      25.7      5141

    4.85      4.95      0.21      42.8      [illegible]      [illegible]

    [illegible]      4.78      0.20      44.9      25.9      5180

    5.19      4.62      0.19      46.9      [illegible]      5103

    5.37      4.47      0.19      48.9      25.5      5095

    5.54      4.33      0.18      51.[illegible]      25.3      5046

    5.72      4.20      0.17      53.1      25.7      5149

    5.09      4.07      0.17      55.1      25.2      5035

    6.06      3.96      0.16      57.2      25.6      5113

    6.24      3.85      0.16      59.3      25.9      5185

    6.41      3.74      0.16      61.4      24.8      4964

    6.58      3.64      0.15      63.5      25.0      5005

    6.76      3.55      0.15      65.6      25.2      5037

    6.93      3.46      0.14      67.7      25.3      5061

    7.11      3.38      0.14      69.8      25.4      5076

    7.28      3.30      0.14      71.9      25.4      5081

    7.45      3.22      0.13      74.1      25.4      5077

    7.63      3.15      0.13      [illegible]      [illegible]      [illegible]

    [illegible]      [illegible]      [illegible]      [illegible]      [illegible]      [illegible]
```

```
                       EL CENTRO WASTEWATER TREATMENT PLANT
                                                           DATE: 08-13-1987
                                                           TIME: 17:37
                                                           BOD:  [illegible]
                                                           TSS:  [illegible]
                                                           TEMP  [illegible]
                         SECONDARY SYSTEM PERFORMANCE


*************************************************************************************
*       *                  *                        *                               *
* FLOW  * CLARIFIER LOAD   * SEC. SLUDGE PROD       *      TOTAL SLUDGE PROD        *
* MGD   *  SFC    * WEIR   * LBS TSS  * LBS VSS* LBS TSS  * LBS VSS  * % SOL  * GPD *
*       * GPSFD   * GPLFD  *          *        *          *          *        *     *
*************************************************************************************

  4.50    448      8653       2747       1929       7291      5565     3.46   25157

  4.67    465      8980       2926       2061       7561      5769     3.42   26505

  4.85    482      9326       3118       2203       7845      5980     3.38   27808

  5.[illegible]  [illegible]  9653  3458  2494     8264      6244     3.[illegible]  30036

  5.19    516      9980       3740       2728       8633      6642     3.25   31886

  5.37    534     10326       3998       2933       8975      6914     3.20   33591

  5.54    551     10653       4250       3135       9304      7178     3.16   35252

  5.72    569     11000       4464       3296       9597      7402     3.14   36690

  5.89    586     11326       4725       3507       9930      7670     3.10   [illegible]

  6.07    604     11653       4922       3662      10207      7882     3.08   39769

  6.24    621     12000       5152       3827      10499      8105     3.05   41228

  6.41    638     12326       5423       4047      10837      8377     3.02   42983

  6.58    655     12653       5615       4206      11112      8589     3.00   44[illegible]

  6.75    672     13000       5859       4375      11403      8810     2.98   45850

  6.93    689     13326       6073       4535      11678      9019     2.96   [illegible]

  7.11    707     13673       6300       4705      11967      9240     2.94   48729

  7.28    724     14000       6515       4867      12241      9448     2.92   50171

  7.45    741     14326       6731       5029      12513      [illegible]  2.91  51[illegible]

  7.6[illegible]  758  14673  7050       5271      12871      9944     2.89   53447

  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]  [illegible]
```

```
                    EL CENTRO WASTEWATER TREATMENT PLANT
                                                           DATE: 09-13-1997
                                                           TIME: 17:[illegible]
                  DIGESTER PERFORMANCE
                        ANAEROBIC
                                                           BOD:  [illegible]
                                                           TSS:  [illegible]
                                                           TEMP  [illegible]

                              PRIMARY DIGESTER VOLUME (GAL):  752000

*******************************************************************************
*        *           *             *        *          *          *            *     %      *
* PLANT  *   TOTAL   *    VSS      * MCRT   *    %     *   ALK.   *    GAS     *    SOL     *
* FLOW   *  SLUDGE   *  LOADING    * DAYS   *   VSS    *   MG/L   *    PRO.    *    DIG.    *
* MGD    *   FLOW    *  LB/FT3/    *        *   RED.   *          *    FT3/    *   SLUDGE   *
*        *   GPD     *    DAY      *        *          *          *    DAY     *            *
*******************************************************************************

   4.50     25257       0.1          30       59.8       3115      49932          1.91

   4.67     26605       0.1          28       58.7       3078      50756          1.92

   4.85     27973       0.1          27       57.5       3041      51567          1.92

   5.02     29346       0.1          25       55.6       2971      52447          1.92

   5.19     31886       0.1          24       54.1       2922      53713          1.92

   5.37     33591       0.1          22       52.8       2885      54779          1.93

   5.54     35252       0.1          21       51.6       2848      55572          1.93

   5.71     [illegible] 0.1          19       50.6       2827      56198          1.94

   5.89     38395       0.1          20       49.5       2791      56927          1.94

   6.06     39769       0.1          19       48.6       2770      57457          1.94

   6.24     41228       0.1          18       47.7       2748      57991          1.95

   6.41     42983       0.1          17       46.7       2721      58634          1.95

   6.58     44374       0.1          17       45.9       2702      59087          1.96

   6.76     45850       0.1          16       45.1       2684      59542          1.96

   6.93     47246       0.1          16       44.3       2667      59952          1.97

   7.11     48729       0.1          15       43.6       2650      60365          1.97

   7.28     50131       0.1          15       42.9       2635      60737          1.98

   7.45     51535       0.1          15       42.2       2620      61091          1.98

   7.63     53443       0.1          14       41.3       2599      61599          1.98
```

APPENDIX D

COMPUTER EVALUATION OF THE CITY SEWER SYSTEM

APPENDIX D

Computer Analysis Results

Tables 2 through 5 indicate the projected wastewater flows through the City sewer system from 1990 until 2020. Results of both options one and two are included to show the difference between the projected flows along Imperial Ave. The included tables are:

Table 2. Projected flows for 1990 with the existing system including peak dry weather flow.
Table 3. Projected flows for 1995 with the existing system including peak dry weather flow.
Table 4. Projected flows for 1995 with option two to show the decreased load placed on the Imperial Ave. line.
Table 5. Projected flows for 2020 with option one showing the expected maximum load the City can expect on its existing sewer system without any changes.

Legend of Column Labels for Tables 2 through 5.

U.S. NODE = UP STREAM NODE (NODE = POINT OF INFLUENT FROM PRIOR AREAS)
D.S. NODE = DOWN STREAM NODE
U.S. INV FT = UP STREAM PIPE INVERT ELEVATION IN FEET
D.S. INV FT = DOWN STREAM PIPE INVERT
LENGTH FT = LENGTH OF PIPE BETWEEN NODES
SLOPE = CHANGE IN PIPE ELEVATION BETWEEN NODES
DA IN = DIAMETER OF PIPE IN INCHES
SIZE CHANGE IN% = SUGGESTED INCREASED CAPACITY OF PIPE IN PERCENTAGE OF TOTAL CAPACITY.
TOTAL FLOW CFS = CUBIC FEET PER SECOND OF EXPECTED MAXIMUM FLOW
TOTAL FLOW GPD = GALLONS PER DAY OF EXPECTED MAXIMUM FLOW
OLD CAPACITY CFS = CUBIC FEET PER SECOND OF PRESENT CAPACITY
OLD CAPACITY KGD = GALLONS PER DAY(x 1000) OF PRESENT CAPACITY
NEW CAPACITY KGD = GALLONS PER DAY(x 1000) OF PIPE WITH SUGGESTED ADDED CAPACITY
VELOCITY FPS = VELOCITY IN FEET PER SECOND OF EXPECTED FLOW
POP = ASSUMED POPULATION OF EACH NUMBERED AREA

Either KGD for thousand gallons a day or MGD for a million gallons a day are used for convenience of column space.

Note: Areas 9, 10, 11, and 12 flow into recently upgraded lines which were difficult to model due to the parallel construction. With adequate maintenance, collection capacity in these areas should be adequate through the year 2020.

EL CENTRO EXISTING SYSTEM, WITH PEAK DRY WEATHER VALUES projected to 1990

TABLE 2

U.S. NODE	D.S. NODE	U.S. INV FT	D.S. INV FT	LENGTH FT	SLOPE	DIA. IN	NEW SIZE	TOTAL FLOW CFS	TOTAL FLOW KGD	OLD CAPAC. CFS	OLD CAPAC. KGD	NEW CAP CFS	NEW CAP KGD	VELOCITY FPS	POP.
1 -A	1 -B	56.47	54.47	500	0.0040	8		0.46	297	0.64	414			2.31	819
2 -A	2 -B	52.26	50.12	300	0.0071	12		0.58	375	2.53	1,635			2.97	654
3 -A	3 -B	47.77	47.01	375	0.0020	12		0.77	498	1.35	873			2.02	746
11 -A	11 -B	45.84	45.17	325	0.0021	12		1.22	789	1.36	879			2.28	1,420
---GOTO 12---															
10 -A	10 -B	41.86	41.71	175	0.0009	15		0.75	485	1.59	1,028			1.46	1,527
---GOTO 12---															
4 -A	4 -B	47.15	46.30	300	0.0028	12		0.28	181	1.59	1,028			1.73	431
5 -A	5 -B	40.67	39.83	375	0.0022	15		0.63	407	2.57	1,661			1.97	1,029
6 -A	6 -B	38.41	37.80	400	0.0015	15		0.74	478	2.12	1,370			1.80	690
8 -A	8 -B	35.26	34.78	350	0.0014	18		0.98	633	3.27	2,113			1.84	884
---GOTO 9---															
7 -A	7 -B	43.51	42.56	400	0.0024	8	10	0.57	368	0.49	317	0.64	414	1.98	1,122
---GOTO 9---															
9 -A	9 -B	39.97	39.75	350	0.0006	18		1.57	1,015	2.21	1,428			1.57	1,180
---GOTO 12---															
12 -A	12 -B	39.28	38.25	450	0.0023	22		3.75	2,424	7.20	4,653			3.13	2,928
---GOTO 15---															
13 -A	13 -B	38.95	37.79	400	0.0029	8		0.48	310	0.55	355			2.05	899
---GOTO 15---															
14 -A	14 -B	39.67	39.15	300	0.0017	8		0.21	136	0.42	271			1.38	307
---GOTO 15---															
15 -A	15 -B	34.34	33.52	500	0.0016	27		3.67	2,372	10.53	6,806			2.75	1,948
16 -A	16 -B	31.42	30.56	450	0.0019	27		3.66	2,366	11.37	7,349			2.90	853
---GOTO 19---															
29 -A	29 -B	55.00	54.12	350	0.0025	8		0.24	155	0.51	330			1.64	360
30 -A	30 -B	52.43	51.84	450	0.0013	12		0.62	401	1.08	698			1.63	1,053
---GOTO 26---															
28 -A	28 -B	57.15	56.79	300	0.0012	12		0.33	213	1.04	672			1.33	526
---GOTO 26---															
26 -A	26 -B	50.32	49.82	200	0.0025	12		0.93	601	1.50	969			2.31	869
---GOTO 23---															
25 -A	25 -B	50.19	49.82	200	0.0018	10		0.56	362	0.79	511			1.82	1,101
---GOTO 23---															
23 -A	23 -B	44.77	43.47	700	0.0019	15		1.73	1,118	2.34	1,512			2.40	1,718
---GOTO 22---															
24 -A	24 -B	48.67	48.32	400	0.0009	10		0.36	233	0.54	349			1.22	583
31 -A	31 -B	48.06	47.47	350	0.0017	10		0.62	401	0.76	491			1.79	907
---GOTO 22---															
22 -A	22 -B	40.00	38.09	800	0.0024	15	5	2.90	1,874	2.65	1,713	3.02	1,952	2.98	2,778
---GOTO 19---															
20 -A	20 -B	43.09	42.46	350	0.0018	8		0.34	220	0.43	278			1.57	545
---GOTO 19---															
19 -A	19 -B	30.23	29.82	400	0.0010	27		6.33	4,091	8.32	5,377			2.66	1,025
---GOTO PLANT---															
27 -A	27 -B	50.85	50.25	375	0.0016	27		0.64	414	10.40	6,722			1.64	1,263
---GOTO PLANT---															

EL CENTRO EXISTING SYSTEM, WITH PEAK DRY WEATHER VALUES projected to 1995

TABLE 3

```
U.S.   D.S.     U.S.   D.S. LENGTH   SLOPE  DIA.  NEW TOTAL TOTAL    OLD   OLD   NEW   NEW VELOCITY  POP.
NODE   NODE      INV    INV    FT             IN SIZE  FLOW  FLOW CAPAC. CAPAC.  CAP   CAP      FPS
                  FT     FT                             CFS   KGD    CFS   KGD   CFS   KGD
-------------------------------------------------------------------------------------------------------
  1 -A   1 -B 56.47  54.47    500  0.0040    8        0.51   330   0.64   414              [illegible] [illegible]
  2 -A   2 -B 52.26  50.12    300  0.0071   12        0.66   427   2.53 1,635                 3.08    775
  3 -A   3 -B 47.77  47.01    375  0.0020   12        0.88   569   1.35   873                 2.10    884
 11 -A  11 -B 45.84  45.17    325  0.0021   12     5  1.43   924   1.36   879  1.55 1,002     2.37  1,683
---GOTO 12---
 10 -A  10 -B 41.86  41.71    175  0.0009   15        0.87   562   1.59 1,028                 1.50  1,809
---GOTO 12---
  4 -A   4 -B 47.15  46.30    300  0.0028   12        0.32   207   1.59 1,028                 1.80    510
  5 -A   5 -B 40.67  39.83    375  0.0022   15        0.73   472   2.57 1,661                 2.06  1,219
  6 -A   6 -B 38.41  37.80    400  0.0015   15        0.86   556   2.12 1,370                 1.86    818
  8 -A   8 -B 35.26  34.78    350  0.0014   18        1.13   730   3.27 2,113                 1.92  1,048
---GOTO 9---
  7 -A   7 -B 43.51  42.56    400  0.0024    8    15  0.66   427   0.49   317  0.72   465     2.06  1,330
---GOTO 9---
  9 -A   9 -B 39.97  39.75    350  0.0006   18        1.85 1,196   2.21 1,428                 1.63  1,398
---GOTO 12---
 12 -A  12 -B 39.28  38.25    450  0.0023   22        4.41 2,850   7.20 4,653                 3.29  3,470
---GOTO 15---
 13 -A  13 -B 38.95  37.79    400  0.0029    8        0.54   349   0.55   355                 2.11  1,065
---GOTO 15---
 14 -A  14 -B 39.67  39.15    300  0.0017    8        0.24   155   0.42   271                 1.42    364
---GOTO 15---
 15 -A  15 -B 34.34  33.52    500  0.0016   27        4.31 2,786  10.53 6,806                 2.87  2,308
 16 -A  16 -B 31.42  30.56    450  0.0019   27        4.30 2,779  11.37 7,349                 3.03  1,011
---GOTO 19---
 29 -A  29 -B 55.00  54.12    350  0.0025    8        0.28   181   0.51   330                 1.69    427
 30 -A  30 -B 52.43  51.84    450  0.0013   12        0.73   472   1.08   698                 1.70  1,248
---GOTO 26---
 28 -A  28 -B 57.15  56.79    300  0.0012   12        0.38   246   1.04   672                 1.38    623
---GOTO 26---
 26 -A  26 -B 50.32  49.82    200  0.0025   12        1.07   692   1.50   969                 2.38  1,030
---GOTO 23---
 25 -A  25 -B 50.19  49.82    200  0.0018   10        0.66   427   0.79   511                 1.88  1,305
---GOTO 23---
 23 -A  23 -B 44.77  43.47    700  0.0019   15        2.03 1,312   2.34 1,512                 2.49  2,036
---GOTO 22---
 24 -A  24 -B 48.67  48.32    400  0.0009   10        0.41   265   0.54   349                 1.26    691
 31 -A  31 -B 48.06  47.47    350  0.0017   10        0.71   459   0.76   491                 1.84  1,075
---GOTO 22---
 22 -A  22 -B 40.00  38.09    800  0.0024   15    10  3.39 2,191   2.65 1,713  3.42 2,210     3.10  3,292
---GOTO 19---
 20 -A  20 -B 43.09  42.46    350  0.0018    8        0.38   246   0.43   278                 1.62    646
---GOTO 19---
 19 -A  19 -B 30.23  29.82    400  0.0010   27        7.49 4,841   8.32 5,377                 2.76  1,215
---GOTO PLANT---
 27 -A  27 -B 50.85  50.25    375  0.0016   27        0.74   478  10.40 6,722                 1.72  1,497
---GOTO PLANT---
```

EL CENTRO PIPE FLOWS DIVERTED SYSTEM 1995 FORCAST

TABLE 4

```
U.S.   D.S.     U.S.   D.S. LENGTH   SLOPE DIA. NEW  TOTAL  TOTAL    OLD    OLD    NEW    NEW VELOCITY   POP.
NODE   NODE      INV    INV     FT          IN SIZE   FLOW   FLOW CAPAC. CAPAC.    CAP    CAP      FPS
                  FT     FT                            CFS    KGD    CFS    GPD    CFS    GPD
-------------------------------------------------------------------------------------------------------------
  1 -A   1 -B  56.47  54.47    500  0.0040   8        0.51    330   0.64    414                   2.36    983
  2 -A   2 -B  52.26  50.12    300  0.0071  12        0.67    433   2.53  1,635                   3.09    784
  3 -A   3 -B  47.77  47.01    375  0.0020  12        0.89    575   1.35    873                   2.11    895
 11 -A  11 -B  45.84  45.17    325  0.0021  12    5   1.45    937   1.36    879   1.55  1,002     2.37  1,705
---GOTO 12---
 10 -A  10 -B  41.86  41.71    175  0.0009  15        0.88    569   1.59  1,028                   1.51  1,832
---GOTO 12---
  4 -A   4 -B  47.15  46.30    300  0.0028  12        0.32    207   1.59  1,028                   1.81    517
  5 -A   5 -B  40.67  39.83    375  0.0022  15        0.74    478   2.57  1,661                   2.06  1,235
  6 -A   6 -B  38.41  37.80    400  0.0015  15        0.87    562   2.12  1,370                   1.87    828
  8 -A   8 -B  35.26  34.78    350  0.0014  18        1.14    737   3.27  2,113                   1.92  1,060
---GOTO 9---
  7 -A   7 -B  43.51  42.56    400  0.0024   8   15   0.67    433   0.49    317   0.72    465     2.06  1,346
---GOTO 9---
  9 -A   9 -B  39.97  39.75    350  0.0006  18        1.87  1,209   2.21  1,428                   1.63  1,416
---GOTO 12---
 12 -A  12 -B  39.28  38.25    450  0.0023  22        4.46  2,883   7.20  4,653                   3.30  3,514
---GOTO 15---
 13 -A  13 -B  38.95  37.79    400  0.0029   8    5   0.55    355   0.55    355   0.62    401     2.12  1,079
---GOTO 15---
 14 -A  14 -B  39.67  39.15    300  0.0017   8        0.24    155   0.42    271                   1.42    368
---GOTO 15---
 15 -A  15 -B  34.34  33.52    500  0.0016  27        5.19  3,354  10.53  6,806                   3.02  2,338
 16 -A  16 -B  31.42  30.56    450  0.0019  27        5.17  3,341  11.37  7,349                   3.19  1,024
---GOTO 19---
 29 -A  29 -B  55.00  54.12    350  0.0025   8        0.28    181   0.51    330                   1.69    432
 30 -A  30 -B  52.43  51.84    450  0.0013  12        0.74    478   1.08    698                   1.71  1,264
---GOTO 26---
 28 -A  28 -B  57.15  56.79    300  0.0012  12        0.38    246   1.04    672                   1.39    631
---GOTO 26---
 26 -A  26 -B  50.32  49.82    200  0.0025  12        1.08    698   1.50    969                   2.38  1,042
---GOTO 23---
 25 -A  25 -B  50.19  49.82    200  0.0018  10        0.61    394   0.79    511                   1.85  1,213
---GOTO 23---
 23 -A  23 -B  44.77  43.47    700  0.0019  15        0.98    633   2.34  1,512                   2.09  2,062
---GOTO 22---
 24 -A  24 -B  48.67  48.32    400  0.0009  10        0.41    265   0.58    375                   1.33    700
 31 -A  31 -B  48.06  47.47    350  0.0017  10        0.56    362   0.71    459                   1.66  1,088
---GOTO 22---
 22 -A  22 -B  40.00  38.09    800  0.0024  15        2.20  1,422   2.65  1,713                   2.80  3,334
---GOTO 19---
 20 -A  20 -B  43.09  42.46    350  0.0018   8        0.39    252   0.43    278                   1.62    654
---GOTO 19---
 19 -A  19 -B  30.23  29.82    400  0.0010  27        7.17  4,634   8.32  5,377                   2.73  1,230
---GOTO PLANT---
 27 -A  27 -B  50.85  50.25    375  0.0016  27        1.99  1,286  10.40  6,722                   2.29  1,515
---GOTO PLANT---

                                                                                       TOTAL POP =      36089
```

EL CENTRO EXISTING SYSTEM, WITH PEAK DRY WEATHER VALUES

TABLE 5

```
U.S.   D.S.     U.S.   D.S. LENGTH   SLOPE  DIA.   NEW  TOTAL  TOTAL    OLD    OLD    NEW    NEW VELOCITY    POP.
NODE   NODE      INV    INV     FT            IN  SIZE   FLOW   FLOW CAPAC. CAPAC.    CAP    CAP      FPS
                  FT     FT                                CFS    KGD    CFS    GPD    CFS    GPD
-----------------------------------------------------------------------------------------------------------------
   1 -A   1 -B 56.47  54.47    500  0.0040     8    15   0.86    556   0.64    414   0.93    601     2.67  1,775
   2 -A   2 -B 52.26  50.12    300  0.0071    12         1.12    724   2.53  1,635                   3.57  1,416
   3 -A   3 -B 47.77  47.01    375  0.0020    12    10   1.54    995   1.35    873   1.74  1,125     2.40  1,616
  11 -A  11 -B 45.84  45.17    325  0.0021    12    30   2.48  1,603   1.36    879   2.73  1,764     2.71  3,078
---GOTO 12---
  10 -A  10 -B 41.86  41.71    175  0.0009    15         1.44    931   1.59  1,028                   1.71  3,308
---GOTO 12---
   4 -A   4 -B 47.15  46.30    300  0.0028    12         0.49    317   1.59  1,028                   2.03    934
   5 -A   5 -B 40.67  39.83    375  0.0022    15         1.26    814   2.57  1,661                   2.38  2,230
   6 -A   6 -B 38.41  37.80    400  0.0015    15         1.48    957   2.12  1,370                   2.15  1,495
   8 -A   8 -B 35.26  34.78    350  0.0014    18         2.01  1,299   3.27  2,113                   2.23  1,915
---GOTO 9---
   7 -A   7 -B 43.51  42.56    400  0.0024     8    40   1.12    724   0.49    317   1.21    782     2.35  2,430
---GOTO 9---
   9 -A   9 -B 39.97  39.75    350  0.0006    18    20   3.27  2,113   2.21  1,428   3.60  2,327     1.86  2,556
---GOTO 12---
  12 -A  12 -B 39.28  38.25    450  0.0023    22     5   7.81  5,048   7.20  4,653   8.21  5,306     3.76  6,344
---GOTO 15---
  13 -A  13 -B 38.95  37.79    400  0.0029     8    25   0.93    601   0.55    355   0.99    640     2.41  1,948
---GOTO 15---
  14 -A  14 -B 39.67  39.15    300  0.0017     8         0.39    252   0.42    271                   1.60    665
---GOTO 15---
  15 -A  15 -B 34.34  33.52    500  0.0016    27         7.70  4,977  10.53  6,806                   3.33  4,221
  16 -A  16 -B 31.42  30.56    450  0.0019    27         7.80  5,041  11.37  7,349                   3.55  1,848
---GOTO 19---
  29 -A  29 -B 55.00  54.12    350  0.0025     8         0.44    284   0.51    330                   1.90    780
  30 -A  30 -B 52.43  51.84    450  0.0013    12    10   1.25    808   1.08    698   1.40    905     1.93  2,283
---GOTO 26---
  28 -A  28 -B 57.15  56.79    300  0.0012    12         0.58    375   1.04    672                   1.54  1,139
---GOTO 26---
  26 -A  26 -B 50.32  49.82    200  0.0025    12    10   1.89  1,222   1.50    969   1.93  1,247     2.72  1,883
---GOTO 23---
  25 -A  25 -B 50.19  49.82    200  0.0018    10    15   1.03    666   0.79    511   1.15    743     2.10  2,191
---GOTO 23---
  23 -A  23 -B 44.77  43.47    700  0.0019    15    20   3.54  2,288   2.34  1,512   3.80  2,456     2.85  3,723
---GOTO 22---
  24 -A  24 -B 48.67  48.32    400  0.0009    10    10   0.64    414   0.54    349   0.70    452     1.40  1,263
  31 -A  31 -B 48.06  47.47    350  0.0017    10    25   1.24    801   0.76    491   1.37    885     2.12  1,965
---GOTO 22---
  22 -A  22 -B 40.00  38.09    800  0.0024    15    40   5.96  3,852   2.65  1,713   6.50  4,201     3.57  6,020
---GOTO 19---
  20 -A  20 -B 43.09  42.46    350  0.0018     8    15   0.60    388   0.43    278   0.62    401     1.80  1,180
---GOTO 19---
  19 -A  19 -B 30.23  29.82    400  0.0010    27    25  13.62  8,803   8.32  5,377  15.09  9,753     3.20  2,221
---GOTO PLANT---
  27 -A  27 -B 50.85  50.25    375  0.0016    27         1.24    801  10.40  6,722                   2.00  2,736
---GOTO PLANT---

                                                                                      TOTAL POP =      65163
```